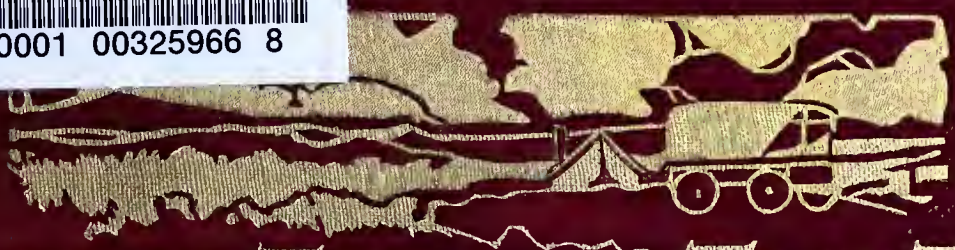

HVNTING EXTINCT ANIMALS *IN THE* PATAGONIAN PAMPAS

FREDERIC B. LOOMIS

HUNTING EXTINCT ANIMALS IN THE PATAGONIAN PAMPAS

The Patagonian Pampas

Hunting Extinct Animals In the Patagonian Pampas

Frederic Brewster Loomis, Ph.D.

Professor of Comparative Anatomy
Amherst College

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PREFACE

When the Amherst Expedition to Patagonia had proved successful, the question arose as to the best manner of presenting its results to the two groups of people who are naturally interested; the alumni and public whose interest is primarily in the general features of the country and in the broad summary of conclusions, and to the smaller number who are interested in the technical details of the structure, relations and origins of the animals the bones of which were found. This volume is written for the former class, and omits the details and discussions of the arguments for one or the other position.

The preparation of the fossils which were found is progressing rapidly and will be complete at an early date, after which a detailed study of these will be made and those descriptions and results will appear next year in a separate and independent volume.

F. B. Loomis.

March 1, 1913.

HUNTING EXTINCT ANIMALS IN THE PATAGONIAN PAMPAS

CHAPTER I

Brazil and the Argentine Republic

The Patagonia of our childhood geography was a no man's land, with big men, vast prairies, and much confusion. The big men are almost gone, but the great prairies or pampas remain, likewise the confusion; which applies not only to the natives, the settlers, the government, and trade, but also to the geology. From the writings of the earliest geologists, especially from that of Florentino Ameghino, have come reports of peculiar and numerous fossil animals buried in the sands and clays along the coast of Patagonia. The bones, jaws, etc., were described and figured. To the rocks in which they were bedded were assigned ages; and it then appeared that such families of animals as horses, elephants, monkeys, and even man, all appeared earlier in South America than anywhere else in the world. This was so at variance with the conceptions already formed, that a vast deal of skepticism was expressed as to the correctness of the ages assigned to the various layers of rocks, and curiosity aroused as to the real relationships of the contained bones.

Every family of animals originated somewhere, and if it was successful, spread over the world, as far as the natural pathways of that time would permit. For instance, the horse originated in the region of what is now Behring Strait during the early Eocene (two and a half million years ago). There were then land connections, linking North America to Asia, northern Europe, and possibly South America: and these first horses spread at least southerly into the United States and southeasterly into

Europe. Did they and their contemporaries also pass on into South America? If not, where did the numerous kinds of South American animals come from? Africa via the Antartic continent or by the way of a trans-Atlantic land bridge has been suggested. The presence of marsupial bones has suggested Australia as a partial source of these animals. One point is agreed upon. South America was isolated from Eocene times until about the ice age, when the present Isthmus of Panama rose and made a pathway by which the recent forms like the puma, wild cats, dogs, foxes, skunks, etc., the guanaco, deer, tapir, etc., entered that continent, and came into competition with those hosts of strange and gigantic creatures of which the sloths, armadilloes, and ant-eaters are the diminutive representatives. But the origin of these typical South American forms is still unknown.

Darwin in his famous voyage around the world found and called attention to their bones in Argentine Republic, both in the north about Buenos Aires and to the south near the Straits of Magellan. Later Carl Ameghino traveled through Patagonia and found more. It was from his notes and collections that his brother Florentino described more than a hundred different sorts of peculiar and typical South American animals ancestral to the above mentioned types. He went further and found that the more distant ancestors of his South American types were related to the more primitive ancestral animals of North America, Europe, and Africa. The beds in which these ancestors were found were "earlier" than those in which similar forms were found anywhere else; therefore, he concluded, South America was the original home of most families of animals. This of course drew attention to Patagonia where the more primitive types were found. In 1896 Princeton University sent an expedition to the Straits of Magellan, which worked from there northward for about 400 miles as far as the Deseado (Desire) River.

They found a wealth of specimens of the earlier typical South American kinds, enriched greatly our knowledge of this fauna, and established the fact that the age of the containing beds was Miocene, which is about a million years later than the date first assigned to them by Ameghino. These explorations while of great value left untouched the lower beds, somewhat further to the north, in which the answer to the sources of the South American animals is buried; so the interest remained unabated, or was rather intensified because the wealth of animal life was further emphasized, and the skepticism as to the ages originally given the various beds was increased.

In the early part of 1911 when the Class of '96, Amherst College, was planning their fifteenth reunion, having taken a previous interest in geological exploration in western United States, they decided to extend their field and take a hand in solving the problems connected with the Patagonian deposits. To this end they organized and equipped the expedition of which the following pages give a narrative for the purpose of studying the geology, and collecting the fossils (especially vertebrate) of Patagonia, in order to get as many data as possible for answering the above questions.

Mr. Frederic B. Loomis of the Biological Department was made chief and directed to prepare plans, select assistants, and get the necessary equipment. Mr. Waldo Shumway was chosen from the Senior and Mr. Philip L. Turner from the Junior Class to represent the undergraduates; and Mr. William Stein of St. Joe, Wyoming, was added to the party to have charge of the horses and cooking; making a party of four; which number, experience has shown, was as many as could conveniently travel with one wagon. Before starting we purchased a 2 3/4-inch standard wagon with 3-inch wheels, a 10 by 12-foot wall tent, a double harness, four saddles, a camera, and excavating tools, so as to have such an outfit as we were accustomed to while working in western United States.

The class held its reunion June 25 to 28, and on July 3 the party started from New York on the steamship *Byron* to take its chance of finding the extinct animals which should be the key to solving the above problems. New York was boiling hot, but once outside the harbor, none of the excessive heat prevalent all over the northern United States and Europe was encountered. Day after day the quiet, found only on a small boat, contrasted with the excitement of the Commencement reunion and the hurry of preparation.

We studied Spanish a little every morning and swam in the canvas tank an hour or more every afternoon. When five or six days out we began to see the small flying fishes and spent hours watching them; trying to form an opinion as to whether they actually flew using the large front fins as wings, or simply glided, the fins acting as a monoplane and the start from the water furnishing the propelling force. Sitting on the bow, one could readily see them dart about with quick movements not unlike those of a trout. For two days the sea was oily smooth, and gave a fine opportunity to study their movements. On the approach of the boat they would dart aside, swimming five or ten feet before leaving the water, then rise above the surface and skim along just above the water, rising to go over a swell or sinking when passing over a trough in the waves. The flights were from a few feet up to over one hundred, and the speed very uniform from beginning to end, 15 to 20 feet per second as timed by our watches. Many a time we located a fish while stationary in the water, saw it start, and within three feet leave the water and travel perhaps fifty feet in the air. From this small start it did not seem possible it could glide so far. Then too the speed was not sufficient to maintain the fish so long in the air. But what was most convincing and easily noted in the still water was a series of ripples beginning at the point where the fish left the water and extending

Neptune Ceremony

five to ten feet until the fish was well above the water, due unmistakably to the beating of the fins on the water as the fish rose gradually above the surface. The take-off reminded one of the way a duck rises from the surface of a pond, striking its wings on the water for a distance until really under way; and we were convinced that these fishes really flew. Further to the south the flying fishes were much larger but not so numerous as they were just after entering the tropical zone.

On the fourteenth of July we approached "the line," said by geographers to be imaginary, but proving to us very real. The first indication of it was at dinner time, when a deep voice from the bow called "ship ahoy, any novices on board?" There were; and we were warned that Neptune would be on board about three o'clock. As six bells struck, sure enough, old grey-bearded Neptune, trident in hand, appeared from the bow, followed by his buxom fair-haired wife, his daughter fresh from a marine ballet, his bibulous doctor, and a crew of minions. After parading the deck, these ancient celebrities mounted a throne on the after-deck and called for the novices. Each man was called up before Neptune, who questioned him as to his purposes in entering his realm. Next we were examined by the "doctor," who always prescribed some of his yellow, pink or blue liquids or watersoaked biscuits, which remedies were administered down the back or up the sleeve. Then the candidate was seized by the minions and taken to the "barber," who lathered with a whitewash brush, shaved with the great two-foot wooden razor, and powdered with soot. During this the victim was seated on the edge of the tank, and as the process was nearing completion, was tumbled head over heels into the water, rising to meet the full force of the ship's hose as he came up. We all went through this with the others, including a couple of sailors and stewards, while the assembled steerage fairly gloated over us; until at the end the

hose was turned upon them. Then Neptune and his following, assisted by the initiates, plunged into the water and the ceremony was over. Later each of us received an illuminated certificate assigning us to various fish families, and entitling us to rove at pleasure over the seven seas.

How old the ceremony is I do not know, but a Spanish traveler in the early part of the seventeenth century describes just such a ceremony as the "rescate" or ransome, differing from the above only in that the duckings, etc., were imposed because the novices could not give satisfactory reasons for entering Neptune's domain, and the captain was fined a dinner for the whole crowd. It is doubtless a mockery of the ancient custom of sacrificing to the god of the sea to propitiate him when the early voyagers entered his realm; but it must have been a deep rooted custom to have survived with so much detail and uniformity. It is only on the palatial passenger boats that the ceremony is dying out.

Five days later, after rounding Cape St. Roque, the easternmost point of Brazil, we came in the middle of the afternoon to Bahia, the second city of Brazil, famous as the center of the South American diamond trade and for its immense and sweet oranges. Here for two hours we tooted vigorously and impatiently for the medical officer, who at his own convenience came aboard, and proved to be an impressive colored dignitary with a uniformed attendant to carry his book.

We had arrived in the midst of a great jubilee. The President of Brazil, accompanied by five war vessels, among them the *San Paulo*, famous for its revolt, was visiting this capital city of the great province of Bahia; and his entire stay was made a holiday, from Friday until Tuesday inclusive, on which days no man worked. As soon as we were allowed we all went ashore to see this picturesque two-level town, and to have a land dinner.

We found a most interesting city flavored by over four centuries of history. The houses were of the low square Moorish style, made of the inferior native bricks, covered with stucco, and then painted white, cream, yellow, pink, and blue, with the cream predominating. With the luxuriant vegetation and their prosperous look they made a very pleasing impression. The contrast between the ultra modern and the mediæval is very marked, the narrow crowded streets being traversed by right up-to-date American trolley cars, to accommodate which the corner of a house is cut away here, or the front moved back there. Two- and four-wheeled carts, with their bottoms made of rope, lined the streets, the tiny mules in front of them looking lost, but drawing corresponding loads of only 300 to 400 pounds.

Flags, electric lights, and the red and green bunting of Brazil made a gay appearance, as did also the uniforms of soldiers and officials. The cutaways, Prince Alberts, dress suits, and silk hats of the civilians should also have been very impressive; but the long-legged slim mulattoes, quadroons, and every other percentage of mixture between Negro, Indian, and Portuguese, failed to carry the corresponding dignity, partly perhaps, because it rained frequently and the damp removed the proper creases and added a host of unconventional wrinkles, and partly also because the trousers were too short for the length of their legs.

We saw the President arrive at the palace; we dined at the "beehive" and went to the theater where we saw "The Merry Widow" in Portuguese. "Saw" is the correct word, for we could not understand the language, and so it was the people and their costumes which interested us. In that large assemblage our impression of the race mixture was not altered; for it seemed as if scarcely five per cent of the people were pure white, that is, Portuguese, but everywhere the blending of white and black showed the

long association of the two races without any great racial prejudice.

The chorus, too, was worthy of notice. To our eyes it was all wrong, but the Brazilians were enthusiastic about the girls; so we saw that the standard by which they were chosen was the South American one, by which the essential qualification is a full deep bosom, rather than the willowy figure desired in the States. At midnight we returned to the boat, and counting up to settle our scores found we had each spent 15,000 reis. It looked pretty steep, but was settled for $5 of our money. Price cards of all sorts struck one as high, beefsteak 1,500 reis, collars 800 reis, car-fare 200 reis and so on; but it takes 30 reis to make one cent of our money, so after all things figure out only a little higher than at home.

Next day the President departed, amidst the firing of many cannon, and then the stevedores came aboard and unloaded our cargo of lumber, oil, hardware, clocks, etc.

A couple of days brought us to Rio Janeiro, said to have the most beautiful harbor in the world. It did not disappoint us as we entered through the narrow gate, close under the 1,000-foot high sentinel or Sugarloaf Mountain, and saw opening out the great bay over twenty miles wide and inclosed in a ring of mountains running up to 3,000 feet in height, cut in the most varied forms and covered with the prevailing olive green of this section.

The city has the same gay colors as Bahia, the same crowded appearance, the same narrow medieval streets, and the same strong contrast between old and new. For instance, through the center of the city has been cut, regardless of cost, a broad Avenida Central, lined with fine European business blocks and hotels, and alive with automobiles. One side of the harbor is bounded by superb English-made concrete wharves, with the most modern cranes and machinery. From the wharf district, a fine boulevard, with a promenade next the water, a wide drive,

then a parkway, and a road for trolleys and heavy traffic, extends seven or eight miles along the water front, passes through a tunnel under the mountain and continues eight or ten miles farther along the ocean beach, the finest drive I ever saw.

We had to wait four days at Rio Janeiro for a connection with the Royal mail boat which should take us the rest of the way to Buenos Aires. This gave us an opportunity to ramble over the city leisurely, to enjoy its active street life, and see a little of its amusement places. On one of these days we went up to the top of the Corcovada, from which eminence one gets a view over all the city and the surrounding country. This part of Brazil is a broad plateau about three thousand feet above sea level, the rock being composed of rather soft, layered gneisses, into which have been thrust from below numerous rounded bosses of much harder granite. Near the sea the gneisses have been cut away by the action of the rains and the waves, leaving the rounded masses of granite standing up above the adjacent country like the buttons in a mushroom bed. The country is further complicated by a series of faults which frequently cut off a side of one of the egg-shaped knobs. We had the good fortune to see the models which Mr. Derby has prepared for the Brazilian national museum and to meet this pioneer geologist, who is laying the foundations of the survey of that country. Most of this work is being done by North Americans, but as yet the great extent of the country has hardly been scratched.

The city is supposed to have about 800,000 inhabitants, but no actual count has yet been made, as the people object to a census; so the population is estimated by figuring back from the death rate.

Finally the Royal mail boat, *Asturias*, came in and we were all transferred to it, sailing away almost at once. Two nights and a day brought us to Santos, the port of San Paulo, the coffee port of the world, three fourths of

all used being exported from these docks. It is the unhealthiest city in the Americas and the widest open town on the coast. From here almost all the Brazilian coffee is shipped, which until a few years ago was raised in excess of consumption, until the valorization plan was devised, whereby the Brazilian Government, backed by the speculators of the world, took a hand and established itself as the sole buyer of the whole crop, and has since been able to regulate both the amount produced and the price paid by the consumer.

The coffee is all put up in 180-pound bags, which are stored in the official warehouses, and finally walked aboard the steamers on the shoulders of some of the most powerful negroes to be found anywhere. Usually they carry two sacks at a time, but in contests have carried seven. They form a powerful union which has prevented the introduction of machinery for loading this product, put up in such uniform packages.

Throughout the city there are hosts of coffee houses, where one sits down to a round table, draws up to himself a tiny cup and saucer, puts in a large allowance of raw sugar, and the waiter fills it up with the inky black syrupy coffee, the finest flavored in the world, and drunk by all classes several times a day. When any café in South America gets the reputation of serving coffee equal to that of Santos, it has reached the top notch.

Formerly the town was considered the worst cholera spot in the world, and no white man would spend the night on shore, the boats even drawing away from the shore for the night. Though still bad it is much improved, but the Europeans engaged in trade there live some seven miles away in a little colony on the seashore.

Mail boats do not carry coffee, so our stay was short, and we went on to Montevideo, the clean, active, modern capital city of Uraguay. From here it is twelve hours up the La Plata River to Buenos Aires, where we arrived

Avenida de Mayo, Buenos Aires

The Docks, Buenos Aires

early in the morning of July 29. Only merchandise being dutiable in Argentine, and our tent, bedding, tools, etc., being considered personal property, we were quickly passed through the customs. Our box of saddles, however, was lacking, having failed to be transferred in Rio Janeiro; and it was three months before we saw them again, during which time we spent almost as much as they originally cost in telegrams, cables, and forwarding charges, before the box was located in Santos and forwarded to us in Patagonia. Baron A. V. Paterson, of the Colonial Oil Company had reserved for us rooms at the Majestic hotel, and loaned us Mr. Marans who, during our stay in Buenos Aires, acted as interpreter and business manager for us.

We found ourselves in the largest city in South America (about 1,200,000 inhabitants), a city bustling with life and booming with enthusiasm. Through it go all the exports of the Argentine Republic, and the country exports the greater part of what it raises (wheat, wool, meats, hides, and flax); while in the other direction is constantly flowing the great mass of imports, for the country imports practically all its manufactured goods.

The old city, with its narrow streets, its one-story houses built around a court, and its stucco fronts, is being rapidly replaced by the large many-storied European business blocks (the major part of the large business of the country is in the hands of foreigners), and by wide residential streets which, especially in the suburbs, are interspersed with parks and open places. Of natural beauty the city has little to boast, but it has been very progressive in its recent improvements. The numerous parks, parkways, trees and gardens, make a fine impression, while the Avenida de Mayo cut through the heart of the old city and connecting the new capital building with the water front, is a street any city might well boast of. It is the pride of the city and is bordered with the best hotels and business blocks in the capital. Frontage on it is as expensive as on

lower Broadway in New York or more so, hardly a building lot on it being held for less than a million dollars.

The docks are fine concrete structures around the series of seven more or less artificial basins which serve as a harbor. These are always crowded with shipping and are finely equipped with all sorts of machinery for loading and unloading. The people claim that the Municipal Theater is the finest in the Americas. The stage and auditorium are nearly as large as those in the Metropolitan Opera House in New York, and then there is a series of anterooms and promenades for use between acts, which may well bring up the size to that of the Metropolitan. The opera here is conducted by the same singers as appear in New York, though they are usually tried out in Buenos Aires first. The class of music is very high, as is also the price for seats.

The streets are thronged with automobiles, through the day every language is heard on the sidewalks, and the people show the hurry and business bustle more like a northern city than any others we saw. It is a most cosmopolitan city and a very expensive one to live in. We hoped to do our business and get a boat south in two or three days, but found that there was no boat for Patagonian ports until the ninth of August, which was very bad for our funds. However, we had a good many last things to attend to, like looking up maps, buying shellac and alcohol, another tent, and a compass, our finances to arrange, and to procure all the introductions possible.

One day we spent in going out to the city La Plata to see the provincial museum, meet some of the geologists, and learn what we could about the localities where fossils were to be found. On entering the depot to take the train, we were at once struck by the European aspect of all the arrangements. Not only were the Argentine railroads capitalized by the English, but they were also built and equipped by them. So the waiting rooms were furnished with tables, at which passengers ate and drank

while waiting. We labeled our baggage and put it in a van, or rather had porters do it as in England, and entered small compartment cars with first- and second-class sections, all quite European. The rates for travel were high, and we learned that the terms granted to the railroads in their "concessions" were very liberal to the railroads, in some cases even guaranteeing them certain profits. Freight rates were also high and very irregular, some short hauls of not over 120 miles costing more than the charges on the same goods, from England to Argentine, 6,500 miles. These rates are fixed by their "concessions," a word full of meaning all through South America. A "concession" is usually purchased and consists of more than franchise rights, being a form of special privilege. It seemed as if everyone had or was trying to get a "concession." While these usually help the city, state, or national treasury for the moment, and often satisfy a much-felt need, they of course have to be paid for by future generations, often several times over, and become great drawbacks to steady progress, especially as it is about them that the worst forms of graft hang.

The trip to La Plata took us through the rich farming country about Buenos Aires, most of which was being used for grazing cattle. During 1910 there had been a great drought all over this northern portion of the republic, the effects of which we saw in that hundreds of carcasses of cattle were still lying in the fields where they had died of starvation a few months before. The rains had come, however, and the brilliant green of the new grass suggested anything but starvation.

The farm houses were small, one-, two- and three-room, box-like structures, the older ones made of half-baked bricks and stucco, the later ones of corrugated sheet iron, and all looking very poor. These we found were the homes of the laborers. Much if not most of the farm land in Argentine is in large tracts, as granted by the old Spanish

deeds. When the railroads were put through the country, the owners of these great tracts were made very rich by the rise in land values, and a large portion of them now live in Buenos Aires, the land being worked by peons, who either work on shares or under foremen. This complete change in farming methods and the jump in land values has created a special class of wealthy landlords who without special exertion are in possession of great incomes; but as they are not themselves farmers and not particularly interested in that sort of work, there is a strong tendency for these great estates to become broken up into small farms either through the necessity of the owner, or because there is great profit in forming a colony and disposing of the land. The presence of these wealthy landowners and the standard of expenditure they set is one of the factors helping to make Buenos Aires the expensive city it is to live in.

La Plata, as capital of the province, has its set of fine buildings, public parks, etc.; but as it is not the home of its leading men, it is largely lacking in fine residences. The men of public affairs mostly live in Buenos Aires, coming out daily to La Plata to attend to the provincial affairs, and returning at night to the metropolis. Our goal was the museum, which is the finest in South America. It is very progressive in some features, notably the ethnological exhibit, which was assembled by Moreno and placed in this museum, and consisted of over 4,000 crania of all the South American aboriginal peoples, together with their implements, costumes, photographs, etc. The set of Argentine prehistoric animals is also very fine and shows the advanced study put upon it by Ameghino. But most of the other departments belonged to the old-fashioned type of exhibits, a series of labels, poorly illustrated with pickled, dried and stuffed specimens.

While the display of curious Pleistocene and Pliocene fossils was interesting, that from Patagonia was sorely dis-

The La Plata Museum

appointing, for there was only a little material on exhibition, and it was labeled as "from Chubut," which is a territory 400 miles long by about the same width. I called upon but found Florentino Ameghino sick unto death, and the other geologists were all in the field somewhere. However, we gathered what information we could and returned to Buenos Aires by another route.

On another day we visited the distinguished naturalist and savant, Prof. F. P. Moreno, and met a most attractive man of the old school, who is a fine linguist, has made a fine art collection, contributed to the literature of his country, assembled the great ethnological collection at La Plata and is the South American authority on this subject. Besides having explored Patagonia, he is one of the best informed geologists of the country. He was very courteous to us, making many useful suggestions, and at parting told us if we ever got into trouble or needed help to telegraph him.

We also visited the department of fisheries, which up to that year has been manned and directed largely by men sent from the United States. For seven or eight years they had been occupied in introducing various trouts and salmons into the mountain streams and lakes of the Republic, the results of which have been highly gratifying; for the fishes soon adapted themselves to the reversed seasons, changed their breeding season, and were multiplying rapidly.

On application the Minister of Interior gave us letters of introduction to the four governors of the territories composing Patagonia, with instructions to aid us; which letters proved of great value when we came into the country where the officials can do so much to delay one.

At the London and River Plate Bank we cashed our drafts, and then I went over to the National Bank of Argentina to deposit my money and take out credits to be used in the south. But here I found that what we con-

sider a common business transaction could not be carried out in this country. The National Bank would not recognize an identification based on a signature, and only a personal acquaintance would suffice to permit me to cash drafts or draw on my own deposits. Then I understood why there are so many foreign banks in Buenos Aires, and put my money in my pocket and carried it south with me.

Mr. Bartleman, the consul from the United States, helped us greatly in getting the latest maps and special literature, also by seeing that our collections were promptly forwarded under consular invoice. In the matter of maps we found that the government was most up to date; in fact, ahead of time in many points, for railroads were mapped for many miles as completed, which have not yet been begun. This caused us to alter several plans and to travel by boat where we expected to go by rail.

Finally the morning of the ninth came, and we went down to the boat the first thing, only to find that we could not go aboard until one o'clock. So we sat down on our baggage, had our tintypes taken, ate the fruits sold on the dock, and kept an eye on the boat. The fruit in Argentine was a surprise. We thought that being just below the tropics with Brazil to draw on we should eat some fine fruit in Buenos Aires, but we had to think again, for the oranges and especially the bananas were of the smallest and poorest flavor. This was true in the great city markets and everywhere we went, a fact which I could only account for by the fruit being native, while tariff walls shut out the products of adjacent states. At last the 3,000-ton *Presidente Quintana* was ready and we went on board, soon to creep out of the tangle of shipping in the harbor and drop down the river to Montevideo.

Here we spent all day loading in oil, lumber, doors, windows, corrugated sheet iron, tracks for a narrow gauge railroad and trucks for its cars, shoes and phonographs from the United States, jams and cloth from England,

bags of Welsh coal, sacks of sugar from France, coffee from Brazil, 250-pound bales of maté from Paraguay, each bale done up in raw hides which had been shrunk around the bundle and made it most compact, canned milk and butter, and so on through a long list. Most of the goods from Europe, going to Patagonia are transshipped at this port as the harbor charges are so much lower than at Buenos Aires.

At night we were really headed south again, but bad weather delayed us so it was some days before we reached the port of San Antonio, chief town of the territory of Rio Negro. We came in through a long narrow, crooked channel, and anchored seven miles below the town, arriving just as another ship finished completely loading up the two lighters which are used to carry the cargo up to the town at high tide. Then the next day was some saint's day and a holiday, so it was two days before we began to discharge our cargo. After more bad weather, during which the boat made but three instead of eight knots as she was supposed to do, we entered the fine Bahia Nueva. The winds were contrary, so instead of going to our port we put into Pyramides where we watched the handling of cargo as it is done in almost every one of the ports along the 1,000 miles of Patagonian coast. Our ship carried a steam tug that fired up as we approached the port. As soon as the anchor was down, this was passed over the side and steamed away to find the harbor master and make out the requisite papers. Meanwhile the two lighters on the forward deck were lowered and the donkey engine began to creak and groan in earnest, while the miscellaneous collection of bags and boxes, and also our railroad, were loaded into the lighters that were making alternate trips to the shore.

From the lighters everything was put onto the shoulders of men who waded into the water up to the waist to receive the freight. They carried it up and dropped it on the

beach "above high-water mark" as their contract reads, and that is some distance here where the tide rises and falls ten feet. Where things were heavy they worked in teams of four, and very bulky packages such as wagons, were unboxed on board and the parts landed separately, including the boxes, which in this lumberless country have a considerable commercial value.

The men who do this work in the water, which summer or winter is icy cold, are mostly Basques from the north of Spain, who ship as a crew for the purpose. While on board they only shift and stow the cargo. They get their keep and about $25 a month, with overtime pay which nearly doubles this amount. They form a strong union which is not to be hurried.

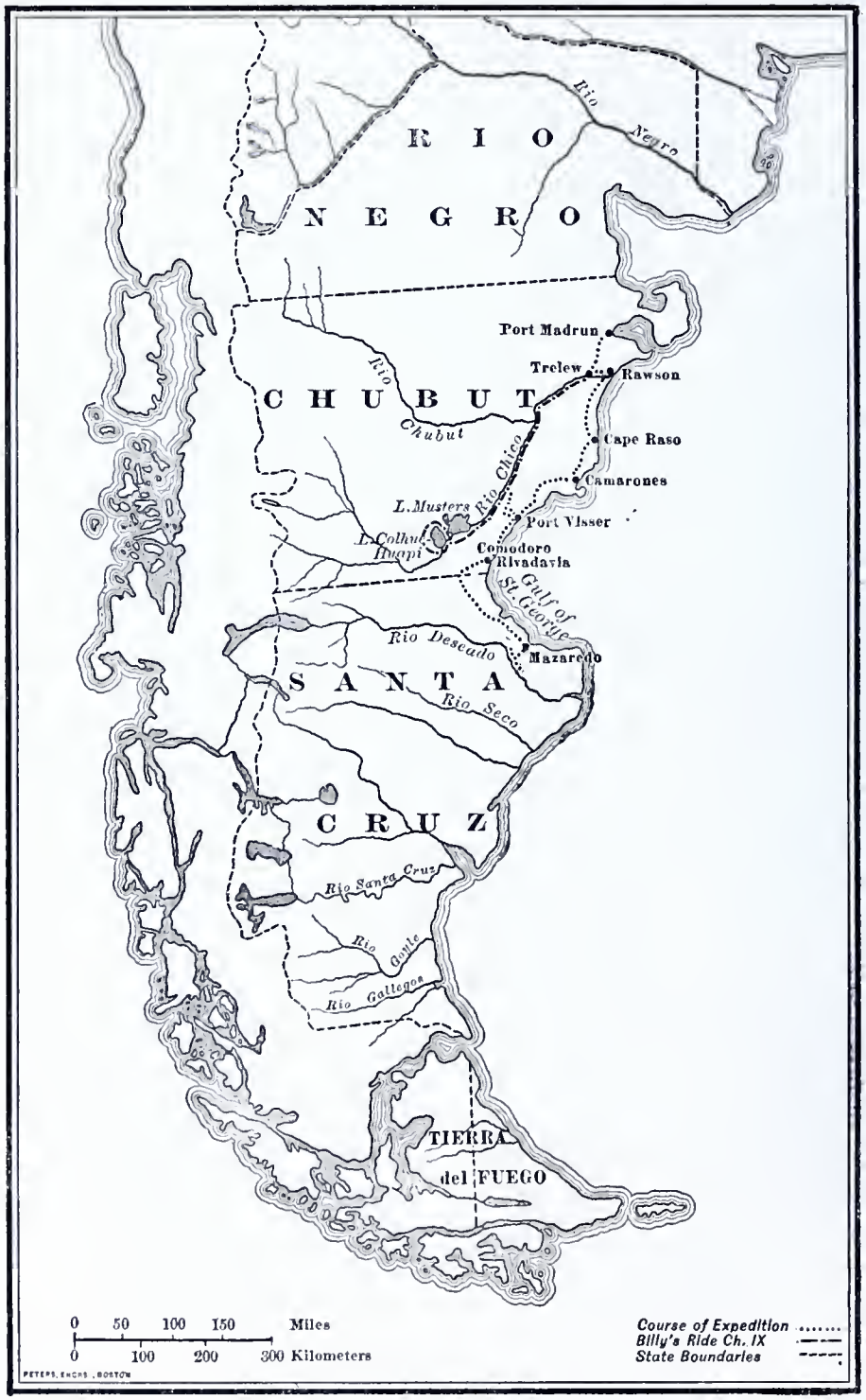
Finally after nine days of steaming and delays we covered the 720 miles to Puerto Madryn, our landing place.

CHAPTER II

Patagonia and the Pampa

At Puerto Madryn we walked ashore over the only pier in a Patagonian port; but before we could get any of our baggage or freight we had to pay a landing charge of a cent a pound for the privilege of using this pier. Established in the "Hotel Britannia" under the supervision of the genial Captain Ross, we explored the sheet-iron town, which during the building of the pier had grown to a population of 1500. At the completion of that structure, however, and with the reduction of the amount of manual labor in the unloading and hauling of stuff from the beach, many of the people left, and we found fully a third of the houses vacant and the numbers of inhabitants not over 700. But hope springs eternal in the soul, especially of the dweller in boom towns; and we were assured that this would soon be the leading port of the south, and that the government was planning to make Bahia Nueva a great naval harbor. There is no doubt that the harbor is big and deep, and that the entrance to the bay could be easily protected across its narrow mouth.

We were at last in Patagonia, which name covers the four southern territories of the Argentine Republic, Rio Negro, Chubut, Santa Cruz, and Terra del Fuego; a country 1,000 miles in length, and averaging about 400 in width. Generally the land rises, either right out of the sea, or within ten to twenty miles from the shore in an escarpment up to a level about 800 feet above the sea, and then stretches away as a vast plain, or pampa, for some 300 miles inland to the foothills of the Cordilleras, where the broken forested country begins. This great southern pampa is entirely treeless, but covered with


R I O
N E G R O
Rio Negro
Port Madrun
Trelew
Rawson
C H U B U T
Rio Chubut
Cape Raso
Camarones
L. Musters
Rio Chico
Port Visser
L. Colhue Huapi
Comodoro Rivadavia
Gulf of St. George
Rio Deseado
Mazarredo
S A N T A
Rio Seco
C R U Z
Rio Santa Cruz
Rio Gentle
Rio Gallegos
TIERRA del FUEGO
0 50 100 150 Miles
0 100 200 300 Kilometers
Course of Expedition
Billy's Ride Ch. IX
State Boundaries
PETERS, ENGR., BOSTON

several sorts of bushes, all low and extremely thorny, among which there is a little grass. This level plain is broken only by the steep walled valleys of such streams as the Chubut and Gallegos rivers which carry water all the year, and the Deseado and Salada which are dry throughout the summer and autumn.

Here in Madryn we tried to buy horses and a few were shown us, but they were such a scrubby lot, small, old, and worn out, that we could not expect them to be dependable for a long journey. Day by day we waited for more which were to be brought in, and learned what *mañana* and *mas tarde* meant.

An Indian Anvil
One-fourth natural size

A Bola Ball
One-half natural size

Between times, when there were no horses about, we explored the shore and found among the sand dunes an old Indian camp site, located I suppose in reference to getting fresh drinking water not far below the surface at this point; knowledge of which fact is today utilized, so there are three big wells near the old Indian camp site. Here the Indians, in the days before the white man came to the country, pitched their tents, cooked their meals, and made their tools. The chips by which the workman is known are strewn over about an acre. We found them in

the trough between dunes, where the sand had blown away and left the heavier pieces behind, as if they had been screened out of the sand. The ashes of the fires were all blown away, but the cracked and indurated stones which the Indians had grouped around the embers told clearly enough of the camp cooking. A few bones of guanaco, ducks, and geese remained from the feasts. The flint arrow-heads, knives, awls, and scrapers were so like those

An Indian Hand Hammer, one-half actual size

familiar to us in North America, that it was hard to believe the makers were a different people, until we searched in vain for the celts, pestles, and grooved hammer heads. Instead, we found broken or perfect spherical bola balls, which the Indians used (and still use except that the balls are of wood) so skillfully. Gripping the raw hide cords by which three balls are fastened together, they swing them around their heads until the balls stand out from

Bluffs Back of Puerto Madryn

Puerto Madryn, Chief Port of Patagonia

The Trail on to the Pampa

(Note the dead horse by the roadside)

each other, then throw and entangle the legs of guanaco, horses, cattle, etc. Most of the Indians of today can, and do, throw the bolas to catch their stock, but the practice is declining as it "bangs up their legs."

Then there were numerous hammer stones of a new type, originally beach-worn pebbles as large as the Indian could conveniently hold in the hand, with one to three pits worked in on either side to give fingers and thumb a firm grip. As a result of their long use, the ends of such stones were much bruised and often chipped. We could find no trace of the hammer head grooved to hold a handle, and none of the many collectors we met had any, so they were presumably not used. Lastly, there were a number of rounded rocks a foot or so in diameter, which we called anvils; each with a pit an inch across in the top, which seemed to have been made to hold objects while they were being broken with the hammers. Throughout the whole trip, scarcely a day passed that we did not pick up some flint implement, or by judicial interest induce the people to give us some which they had found.

All along the beach there lay worn remnants of great oyster shells often ten inches across and three inches thick. We were told that these were originally washed from the bluffs, and that they occurred in places in the hills four or five miles back of the town. So Sunday morning we took an early start and spent the day among these bluffs, finding that the lower part was composed of white sandy clays which are supposed to be ancient river deposits, but were destitute of fossils. The upper 500 feet, however, were brown sands, in the lower layers of which we found the big oysters, liberally sprinkled, making a very definite oyster bed, some of the individuals here running up to a foot in diameter. Here we also found beds of smaller oysters of at least two species which remind one of modern ones. In the topmost layers there were occasional marine shells and logs of petrified wood, which must have been

driftwood. The big oysters were so characteristic and so universally present that throughout the trip we used their bed as the fixed level above or below which we located our finds. On this occasion we found so many that we wanted to bring home that we had to pile them in heaps and leave them. Next day, while Stein and Turner put our wagon together, Shumway and I went out with a horse and two-wheeled cart and brought them in, at the same time making a carefully measured diagram of a section of the bluff. Here we had our first taste of the ever-blowing wind which sweeps across the pampa. To work at all it was necessary to wear goggles, as the sand blew into our eyes every time we touched the ground in any way, and it was almost impossible to stand on the exposed shoulders of the hill.

Finally a long-waited-for bunch of horses came in and the two likeliest were hitched into the wagon for trial. Every time the brake was put on to make the pull heavy, they balked; so we drove right over to the narrow gauge railroad, got a flat car, loaded all our property upon it, and in two hours were sitting in the first-class half of the only passenger car on the train speeding—so to speak—toward Trelew. The forty-two miles were covered in two and a half hours, all of which time we were passing through the sheep ranges given as a grant to compensate the company for building the road.

Trelew is the largest town in all Patagonia, having some 2,000 inhabitants, and being the center of the Welsh colony, which came to this land about 1865 to obtain freedom to worship in their own way. They took land in the valley of the Chubut River; land that looks desperately bad, but which when irrigated yields good crops, especially of alfalfa and oats. These Welsh build their houses of adobe bricks, making a neat and comfortable home, though never luxurious. For years they struggled to get a bare living, until about 1890, when, as more people began to settle

in Patagonia and made a market for their products, they began to prosper. Then in 1900 without warning the rains fell in the Andes some 600 to 700 miles to the southwest. Lakes Musters and Colhue-Huapi overflowed and a flood came down, filling the whole valley, and destroying most of their previous work. That and a previous drought pretty well discouraged all the settlers; so when they appealed to the Federal Government for help, the duties on all imports into Patagonia were remitted, and these ports still (after ten years) were free ports. The help was effective, and prosperity is today greater than in the pre-flood days.

In the Spanish stores in this country the custom in trading is still to have no marks on goods. The storekeeper asks a price, the customer makes an offer, and the purchase after a proper amount of dickering is made at an intermediate price. The result is, varying prices to different men, according to the skill of the traders. These methods did not appeal to the Welsh, and very shortly after arriving, they formed the Chubut Mercantile Company to buy supplies in England and sell to themselves. This was organized as a coöperative concern which they claim is the oldest one still doing business. It is over forty years old and now at the height of its prosperity. The original stock sold for $5 a share, and these same shares are now worth $60. The managers are salaried, the prices are fixed on a percentage-over-cost basis and clearly marked on the goods. Members and non-members buy at the same price; but a record of all sales to members is kept, and at the end of the year the profits are figured up and a dividend is declared on both the face value of the shares and on the purchases at the same rate. This dividend has for years been between twelve and twenty per cent. The parent store was so successful that there are branch stores all through Chubut, and not only the Welsh, but the Germans, Scotch, and Spanish are also shareholders. The

institution has been so well managed that the people would rather place their money in its hands than in the banks, and they also do a considerable banking business, pay two per cent. on current accounts, four per cent. on accounts requiring three months notice for withdrawal, and six per cent. when deposits are made for a year or more.

The effect on other business has been to set a standard, which the Spanish firms have adopted as far as it is possible for them to do so by nature, and when in the same towns with the Coöperative, they have marked prices, give receipts, etc. They have also organized a *Coöperativa Chica* on the same lines. Besides these there are several important trading corporations, especially the *Sociadad anonima;* the word *anonima* being equivalent to incorporated (and very common in firm names), though it means without a name, the absence of the names of the men behind a corporation being in the beginning apparently the most striking feature of their organization. It was with the Welsh coöperative store that we did most of our trading.

In Trelew I had an introduction to Mr. Howell Jones, old timer, railroad agent, and cordial host. He found hotel space for us, a place for meals, and next morning introduced me at the bank and to the leading business men of the place. I had to be introduced at the bank before they would accept my money on deposit. They took it and gave me a receipt, also a statement signed by the President stating that the signature below was mine, and that I had 2,000 pesos deposited there. All this did not help me at all to draw it out later in Comodoro Rivadavia, though they said that it would.

The next five days were spent in going among the Welsh farmers looking for horses. We also tried to get mules, but were not successful in this. On Sunday after borrowing articles of clothing from any one in the party who had better than I, accompanied by an American—Mr. Crockett —I drove over to Rawson fifteen miles away, the capital

of the territory, to call on the Governor, and present our letter of introduction from the Minister of Interior. He seemed much interested in our plans and offered to give us a general pass through the territory with instructions to all officials to aid us where possible.

This proved very valuable to us, for North Americans are viewed askance down there. Two of our fellow-countrymen held up a train in Texas and were so much wanted that a reward of $10,000 was offered for them dead or alive. They moved to the back country of Patagonia and were quiet for three or four years. A year or so before our arrival they had gone down to Gallegos and deposited about $1,000 in the bank; then they invited the President of the bank and leading citizens to dinner,—in fact for a couple of days they entertained the town. When ready to leave they entered the bank, pulled their guns and held up everyone while they gathered together about $40,000 and departed. They also held up an interior store which carried a large amount of cash, and in the mêlée, killed the proprietor. They were said to be "good fellows," for they never robbed poor men, and at the store gave six dollars back to an Indian who was trading at the time. Several posses had been sent out after them, but few believed that they were really anxious to meet the North Americans. Whenever we announced that we were North Americans there seemed to be a feeling that we might be similar to, or in some way connected with, our too well-known fellow-countrymen. But time after time we produced our letter from the Governor, with the effect that distrust changed to the most cordial hospitality, which is the normal manner of the Spanish frontiersman (or of the frontiersman of any nationality) in greeting strangers.

It was Friday night when we reached Trelew. Tuesday morning about eight o'clock we bought our first horse, "Colorado," which I used for a saddle horse throughout the trip. He had just come in from the Cordilleras, and

after but three days' rest started out on the road again, a good horse, rather hard gaited, but with spirit and endurance. We borrowed a sulky, hitched him in and spent the day driving from farm to farm to see other horses. At night we had a team, "Betsey" and "Pet," each weighing about 1050. They had been badly handled and had a reputation for balking, but under Stein's hand soon got over that and proved he had a good eye in picking them. Then we picked up a pony called "Paddy," twelve years of age, but experienced in all sorts of work and tricks. Next morning we added "Blackie" as a saddle horse for Turner. They all turned out sound and good; $55 was the highest price we paid for any horse, and Paddy cost but $25. These were typical prices for good horses, though they can be bought for even lower prices, down to $5 a head, which was the value put on the unbroken native mares, used for breeding purposes. These are usually bought in bunches and kept back in the mountain country where there is good grass for feed.

Many of the Welsh colonists, besides their farm, had a league (nine square miles) of land back in the Cordilleras, which had been given as pay to each man who served in the Indian campaigns some twenty years before. At present, now that the Republic aspires to be counted as one of the military powers, all the young men when they attain the age of twenty, must serve one year in the army or two in the navy, the class of service being determined by lot.

Our saddles were still astray, so we bought a couple of the old Boer War army saddles, some hundreds of which at the end of the war, the English Government had sold to the coöperative stores, and which were retailed at about $10 each. They made us very serviceable saddles though not so easy for long continued riding as are our western cow saddles.

Wednesday was a holiday, but the Justice of the Peace kindly made out our bills of sale for us. All through

Patagonia, every sale of an animal or a hide must be registered in the office of the Justice; who will not make out a bill of sale until ownership has been proved either by production of the former bill going with each animal, or, when the owner has raised the animal, by proof of the registration of the brand. While often troublesome, for the office may be miles away, this is a fine guarantee of ownership, and protection against theft, for only an owner can dispose of an animal.

As the universal practice of the country is to drive three horses abreast, we had our doubletrees lengthened so our horses could walk in the two outside tracks. The Patagonian wagon has thills, between which they put the best horse, and the others are hitched to single trees on either side. More horses can be added either in front or by hitching them by ropes to the axles or even the wagon box.

About two in the afternoon we began to load in, which attracted nearly half of the town as spectators. There is usually enough in the first packing of the wagon to make one irritable, for nothing fits, ropes are new, and everyone is a little nervous. Our crowd was openly skeptical of a two-horse team, in fact of anything less than twelve to twenty horses to be used in relays; and besides inspecting everything, insisted on giving us advice and offering bets as to whether we would go three or four days before getting stuck, or as to where our horses would die on us. However, we had faith in the North American method of traveling, that of using few horses and feeding them.

At 3.30 we got away on the road to Rawson, Shumway riding Paddy for his first experience on horseback. After getting a good start I rode ahead to arrange for a stopping place, and to see the Governor again. For about ten miles Shumway kept up, then concluded to let his horse walk in the rest of the way. When next seen he was relieving his indignation in English on a Spanish audience. He was sore enough, but the small boys had sensed the

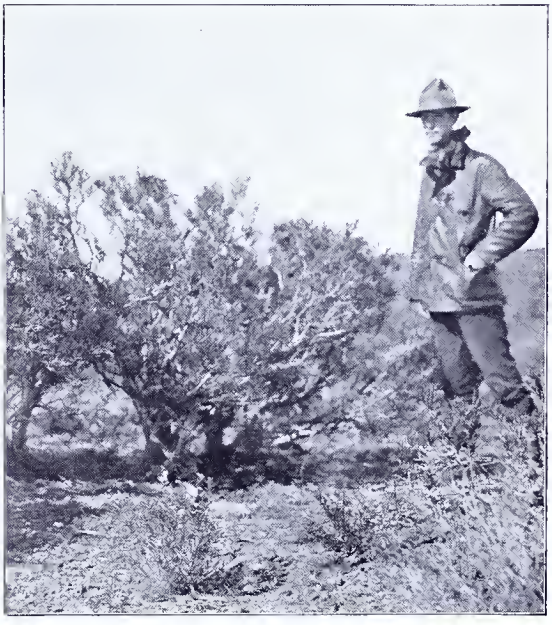
situation and threw stones at his horse. This did not tend toward a smooth gait, or to making Paddy any more manageable. It was eight in the evening when the wagon rolled into Rawson, and we got supper at the Paris Hotel.

Next morning, the first day of August, we got away in good season, accompanied by a policeman mounted on the regulation mule, to act as our guide until we were well on the right road. From the village we plunged at once into the unsettled country and began toiling up the long hill onto the pampa. This is not the rich grass-covered prairie sprinkled with cattle, about which one reads, and which lies far to the north in the neighborhood of Buenos Aires, but a gravely barren level, covered with several varieties of low thorny bushes, with a scant growth of dwarfed grass between them, and occasionally a tuft of coarse pampa grass two feet high. It was early spring and what little grass there was, was just starting. As time went on we learned the characters of the various bushes.

The large malaspina is as typical and abundant as any, ranging from two to six feet in height and leafless. The branches end in forked greenish spines, containing the chlorophyll which does the work usually carried on by the leaves. Its hard woody stems often reach a diameter of six inches and when dry make a fair fuel. In the branches of this bush we often found large globular nests, made of interwoven thorns, in the center of which a small sparrow-like bird found a capital protection. Another bush was called by the people *chaca colorado* or red wood, and this proved a real comfort, for its thorny branches with their small leaves, seemed to be filled with some sort of pitch, which made the wood burn well whether dry or entirely green. The roots, which are much larger than the stems and run long distances out from the bush, are even better fuel, so that throughout the whole country the people grub them out for fire wood; and slack, indeed, is the householder who has not a goodly pile of the gnarled and irregular roots in

Professor Loomis Securing Firewood from a Malaspina Bush

The Calefate Bush



Mr. Turner Prospecting a Chaco Colorado or Redwood Bush for Fuel

his dooryard. When burned they not only make a hot fire, but the embers hold fire almost like coal, and leave behind a clinker-like ash which suggests that the wood in it contained a good deal of inorganic matter. We had expected to have trouble in getting fuel as the travelers on our western prairies do, and had appointed Shumway chief high-collector-of-the-wood, but this bush took from that office all its difficulties.

Another common bush is the *callifate*, and this has thin delicate leaves, and bears a small red barberry-like berry, the only fruit in the country, which with plenty of sugar can be made into a jam. The wood, which is bright yellow in color, is a poor fuel, for it will not burn green, and is light and quickly consumed. Still another and smaller bush bore broad evergreen leaves, each ending in a sharp spine, but the wood of this never got large enough for fuel. It is, however, another of the plants full of pitch, and so inflammable that if fired the whole bush will blaze up and burn rapidly, making a dense smoke which is often used by the herders for signals; or a bush may be lighted to warm one's hands by during cold weather. Besides these most prominent bushes there are several others, among them a low one without leaves but with the stem green and jointed not unlike our horsetails, which bush was much eaten by the horses and sheep. All these bushes had bright and conspicuous blossoms which, opening one after another, made the immediate landscape very attractive. The colors of the flowers were mostly yellow, though there were one or two with white blossoms, but red and blue flowers were conspicuously lacking.

At noon our guide left us with some pesos in his pocket, and we pushed on to a small *laguna* or fresh water pond which remained from a larger one made by the rains. We had covered twenty-three or twenty-four miles, which during the early part of our trip was an average march, though later we could make considerably more. For the

first time we were really face to face with the problem of how the horses were to get enough food. There was not enough grass for a horse to fill his stomach if picketed, nor could they help becoming entangled in the bushes if they had a long rope attached to them. After feeding each horse about two quarts of grain we put hobbles on their front feet, and turned all but one loose. Then we pitched our tent, got supper and were very glad to gather inside around the little iron stove which particularly had called forth jeers.

After sundown the temperature dropped below freezing and a stiff wind blew all night, as it had done through the day; as in fact, it was to do every day. It was indeed a day of relief when the wind was not howling, and its continual performance often called to our minds that Dante had made this the feature of his second inferno, constantly blowing the spirits from place to place. Though it was springtime we were glad to wear woolen sweaters under our leather coats; nor were we able to shed the sweaters for more than a few hours at midday, at any time during the trip, even in midsummer, for there is no time of the year when the nights get warm, or when frost may not be expected. The winter, however, is correspondingly mild, snow scarcely ever lying more than a day, for the sun at noon warms things up, and the snowfall is light. This is between latitudes 42 and 46 south, which would correspond with Massachusetts in the north. Apparently the ocean on the one side tends to keep the temperature from extreme cold, while the snow-clad Cordilleras, only 200 to 400 miles away on the other side, prevent the warmth from becoming general.

The first night with a new outfit is always an anxious one. We had taken pains to have a mare in our bunch, for horses do not readily leave them; but the question was would they try to start back home during the night, and would they all know how to pick up a living under these circumstances? The real farm horse would have starved.

Billy and I alternated through the night in watching them, going out among them every hour or so, and in the meantime squatting over a little outdoor fire, making large plans, and comparing the southern nights with those on our western plains.

The sky over the pampa is by no means the equal of that over the prairie, for it has fewer brilliant constellations, and always seems so far away, while on a clear night in the west of the United States one feels one can almost touch the stars, so near do they seem. And the famous "southern cross" must disappoint every northerner, when first he sees it; for the four stars arranged in a diamond with one or two very dim ones inside, do not for a moment compare with our bright north star and the great dipper, which draw the eye of every camper, and settle in his mind the points of the compass that by then are often a bit confused.

CHAPTER III

Life on the Arid Plains

The next morning we had breakfast before daylight, brought in the horses, broke camp, and were on the road about seven, which was then about an hour after sunrise. Our motto was, "go slow but keep at it." After lunch it began to rain, but as there was no drinking water in sight, we kept pushing on until about six, when a light was spied, and after another hour we came to a little mud-walled puesta, the frame of which had been filled in with twigs, and then the whole daubed over with mud, and covered with a roof of second-hand corrugated iron. Having been used before, this roof was full of nail holes and let in the rain badly. The house had no chimney and the fire was in the middle of the floor, so that the ceiling was covered with soot, and when the rain water came through and dripped on the inhabitants, each drop had its load of black. We found two men and two children occupying the two-roomed hut. They asked us in, and as it was now pouring and the wind howling, we were very glad not to have to pitch a tent. We dared not turn the horses loose, as before such a storm they might drift entirely away from us; so they were tied up to the lee side of the house and went hungry except for the little grain we could give them. Upon coming into this home, we had our first experience of the *maté* custom which is prevalent among the country people, and many of those in the towns.

Our host took a gourd from the shelf, filled it about half full with *maté*, a tea-like herb from Paraguay and southern Brazil, filled it up with hot water, and put in the *bombillo*, a metal straw with a perforated bulb at the base. As eldest guest this was passed to me first. I drank out the

liquid tasting not unlike boneset tea, and passed it back. It was refilled with water, and passed to the next one, same cup, same *bombillo;* and so it continued to make the rounds of the company and hosts until supper was ready. The individual drinking cup idea has not reached this section, and one would like to choose one's turn, but to hesitate would be the greatest breach of hospitality. The natives spend hours squatting before a fire, sucking the *maté* and chatting.

Our supper was a side of mutton, threaded on a long iron spit, which was driven into the ground so as to incline over the fire. When the meat was cooked through, the iron was taken from the fire and thrust firmly into the ground in our midst. The etiquette of the occasion required each man to draw his sheath knife (which every man in the country carries in his belt), and for the first man to cut off a small helping from the upper corner; then in turn everyone sliced off a rib from the bottom up. Mutton, *maté* and *galletas* made our meal, the last being oval biscuits which had been baked and then thoroughly dried. These are sold everwhere by the kilo, their virtue being that they will keep indefinitely.

After only a little conversation, for the natives had difficulty in understanding our Spanish, we turned in, two of us in one of their beds, the others on the top of the load under the wagon cover. In the morning we had a breakfast of boiled mutton, macaroni and *maté.* Among these people, engaged entirely in caring for sheep, and in a country where canned and dried meats are unknown, and the enterprising canned vegetable has not penetrated, practically the whole diet of the people is mutton, with some macaroni and rice. Something like *maté,* therefore, has to be used to keep the bowels in condition, and in a short time the taste is acquired, so that although tea and coffee are being introduced, there is no diminution in the amount of *maté* consumed.

Though it was still raining we got ready and started on the road. Just as I was mounting my horse, Paddy pulled away from me and started back toward home. It took over four miles of coaxing, cussing and manœuvering, before he was ready to be caught. The wagon had gone ahead, but about noon we all got together once more. After noon it began to pour again, and when we had to come down off the pampa, the mud got deeper and deeper, until at last we rounded a hill and saw the most welcome *Dos Posos* (two wells) before us.

Along the telegraph line from Buenos Aires to the Straits of Magellan, at intervals of about fifty miles there are stations for the upkeep of the line, which also serve as post-offices and meteorological stations. Here one can send telegrams, and mail is brought in or out "whenever any trustworthy person happens to be going to the nearest port," usually at intervals of months. Pulling up to the house we asked for shelter and supper. There were only a woman and some children there. She was sorry but neither was possible. I went back to the wagon and got the Governor's letter, and then there was plenty and we could bring our beds into the front room! (Throughout the country no one has extra beds, travelers being expected to carry their own; so usually a horseback traveler is accompanied by his pack horse with blankets, etc.) The house was a government building and built of wood, with a floor in the front room, though the other rooms had none. There was also a fireplace in the kitchen (but no stove), but next day the fire had to be removed to the middle of the room to keep it going. Here we had the same meals as before, except that the boiled mutton was served at night, and in two courses, the first being soup, the mutton being removed, and for the second it was replaced and served as the *pièce de résistance.*

This was the beginning of the biggest rain any of us had experienced. We saw in the morning that we were

A Government Office, Dos Posos

Abandoned Hotel in the Canyon

mud-bound, so we put up our tent, and moved in beside our own fire, where we were more comfortable than the occupants of the house. For four days it poured and the wind howled, and every native rejoiced, for it was the first rain the country had had in eighteen months. Each morning we rose late, had breakfast, and then went out for two or three hours to hunt up our horses, bring them in, and feed them, and also to gather in some wood. Then we could come in and read or sleep until it was time to go out again and find the horses and give them their afternoon feed. We were soaked to the skin all the time, and chagrined at being stuck. At last it stopped, and after spending half a day drying out our tent and bedding, we hitched four horses to the wagon and started through the mud up the three-mile hill from the wells.

Toward night we came to the first ranch, that of Rudolph Zahn, who allowed us to stop at his place, gave our horses a feed of grain (we had run out), and let them fill their bellies with good alfalfa. They had suffered considerably from exposure in the long cold rain. He invited us up to the house to supper and gave us a royal German meal, with home-made breads, wursts, butter and even milk, all luxuries of the highest class in Patagonia. Fortunately, we had a command of the German language, so spent a most enjoyable evening with him. Next morning we had breakfast, and then photographed his family and the ranch; which we found pleased the people more than anything we could do, for in those parts, they never have an opportunity to get pictures of their family or of their homes.

Herr Zahn had a ranch or *estancia* of twenty leagues, and told us something of sheep raising, which differs much from the same business in the western United States. The sheep are mostly Merinos and Merino grades which were brought to Argentine from Australia; so most of their methods and the terms used in working the sheep

are Australian. Not over fifteen hundred can be grazed on a league, which is about one sheep to every seven acres, and they live mostly on the bushes in spite of their thorns, eating even the malaspina when the thorns are coming out and are still soft, so that men who have cleared their land of the brush have found themselves poorer, instead of better off. The only large carnivors are the pumas, which are now pretty scarce except in the mountains; and even they seem to be much inferior to their North American representative, the mountain lion, for a rider will often corner one and kill it with his stirrup iron or some similar weapon. Thus it is possible simply to turn the sheep out on the pampas, a herder riding out every morning to bunch them up and see that they do not wander too far from water or get mixed with other "mobs." When inside a fence they are inspected but once a week or so. Thus the typical peon who herds has a comparatively easy time, in good weather often being back from a day's work by ten in the morning, though in the lambing season and in bad weather he may be out all day. These herders are mostly natives. Each one owns his own horse and is very independent. If he does not like a piece of work or the owner, he simply rides away and begins visiting around until he feels like taking another job. For months he may visit around, for hospitality is so much the custom, that he can live on nothing, except his tobacco money. This has become in many cases such a nuisance that many of the larger *estancias* have had to limit the length of visits, and some even make a small charge for transients. This last, however, is very unpopular through the country; for every one when he travels must stop at the *estancias*. When we left Zahn's he sold us a bag of grain for our horses, and gave us half a sheep. We started south, keeping well back from the coast to avoid a notorious stretch of deep mud.

All went swimmingly until toward six, when we entered

a long canyon, expecting to reach a deserted house where quarrymen sometimes stopped. Coming up the canyon with four horses on, for the going was bad enough, the wagon suddenly dropped down to the axles in a hole. No amount of pulling, or digging and blocking up of wheels, sufficed to get us out, as the horses were up to their bellies as well. So we had to unhitch them and unload everything in the wagon. Then by hitching the horses to a long rope and prying up the wheels with levers we got the wagon out and upon a drier spot some 300 yards ahead, and we started in to bring up all our stuff by hand, some of which was pretty heavy. It was nine o'clock before the tent was pitched and all the stuff under cover, either in the tent or the wagon, and we turned to getting supper. Before that was over it had begun to rain again.

On getting out next morning to see where we were, we found ourselves between the 200- to 300-foot walls of a narrow canyon in an ancient lava flow, with a deep slough behind and another in front, and the rain descending steadily.

Half a mile ahead we came upon an old quarry where the trap rock was fissured in parallel seams, and at some time a large quantity had been worked out in thick flags, which, however, had never been taken from the canyon, but still stood in large piles. Against the face of the opposite cliff was built an old stone house, perhaps sixty feet long, by ten feet wide and seven feet high. This was divided into a series of rooms each lined with bunks. In places all through the canyon the road had been extensively worked, the creek being crossed with stone bridges, and where it had climbed upon the slopes, the lower side was walled up to some height. We had heard of an old road formerly considerably traveled by freighters before the steamers plied along the coast, and now we had come upon one of the ancient stations, which must formerly have been of great importance, judging from the work done about

it. Then there was always water here, and none on either side for a big day's journey. We had to give up all hopes of getting ahead until it dried out a little; but the next day Billy and I took the saddle horses and started to hunt up a road. We found the canyon had two heads, one outlet being blocked by the formation of a pond six feet deep clear across the road, the other about ten miles longer and leading out into a big swamp through which the road lay. It looked dubious, especially as a sheep herder whom we met assured us the swamp was the only way out.

After two days the rain ceased. With the appearance of the sun, our courage rose, and Billy decided to tackle the shorter way. The baggage was divided into two unequal parts, and the lighter load put on first. Then we went ahead and built half a mile of road with brush and flat stones, across one of the stickiest places. With the four horses and frequent rests we ploughed through the mud, often taking to the bed of the stream, until we got to the pond. Here we did a fancy piece of road building, laying a course up over a talus slope upon a rock spur. The upper wheel track had to be dug out and a wall built for the low wheel to run on. The load was shifted to the upper side of the wagon. One horse went ahead to lead the way and four were put on the wagon. Then with a whoop the procession started. The wagon struck rocks, swayed; Billy yelled "keep going"; the horses were down and up; but in two minutes they stood panting and trembling on the top. The descent was not so hard, though the chances of an upset were the same. This obstacle overcome, the rest was simply a slow pull up to the level of the pampa, where the load was taken off, the wagon stripped of its top box and every non-essential, and we went back to repeat the operation. The second trip was even better, for the horses had more confidence, so that by dark we were out of the canyon and ready to go ahead again.

Next morning found the horses back by the pond. They

liked the canyon as it afforded shelter and more feed. When all were hitched up, Paddy made a break for liberty and went back on a run. Billy jumped on Blackie who disappeared with a rope swinging as he went. I mounted the Colorado and followed the procession, but did not catch up, until by the old house I found Billy on Paddy's bare back. He had cornered Paddy and dismounted to put a rope on him for leading, when Blackie took advantage of the opportunity and bolted in his turn; but when my horse came up he was satisfied to be caught and join the company again.

We all finally got to the wagon, where the boys had everything ready and we were off about nine o'clock. The country soon became broken, with fine much-gullied exposures of the rocks on three sides, the dissected rills reminding us of the Big Bad Lands of South Dakota. It was too good to pass; so at noon we hauled up to a deserted house and made a camp, starting out at once to prospect the ledges. The base rock was an extensive lava sheet, in a canyon through which we had been stuck. This was covered with about 100 feet of red sandstone, above which were 200 feet of white clays, all capped with the marine oyster-bearing sands. It seemed to correspond exactly with Ameghino's description, the red sandstone being his "dinosaur beds," and the white his "Notostylopus layer," in which we expected to find bones. It was late when we came in from the various directions, each hoping that the other fellow had had better luck than himself, but all reported the same barrenness.

The next morning's drive brought us down to the seashore again, where while lunching we watched twenty or more sea lions work around on the beach. These were the southern sea lion which we saw at several points from here south. In the early half of the last century there were numerous sea elephants, and also fur seals along the Patagonian shore, which were killed in large numbers, the sea

elephants for their oil, the seals for fur. In an attempt to prevent the imminent extinction of these forms, the Argentine Government passed a general act prohibiting commercial fishing along the coast, but as they did not have police boats, the fur seals and most of the sea elephants were, nevertheless, practically destroyed. As the prohibition against fishing still remains, the result has been that there are no fisheries along the coast, in spite of the fact that the sea is full of good fishes for the purpose. One in particular, the *peccare*, comes in each spring to spawn, approaching so close to shore, that when the tides go out, many are caught in the pools, and the natives along the shore come out and spear or net them in considerable numbers, drying them in the sun much as cod is dried in Nova Scotia and elsewhere. They are very good eating and undoubtedly of considerable commercial value, were the people free to catch them unhampered. As it is, in some of the stores we were offered northern codfish of unknown vintage, at high prices. There are several other edible fishes along the coast, in particular a herring along the southern part. We heard of two concessions to fish for market, but compared with the possibilities that is very little; and the entire absence of fishing craft, of all small boats, in fact, strikes the traveler as curious.

Just back of the raised beach where we were lunching, there was a long lagoon of brackish water, and on it were numerous geese, ducks, gulls, and flamingoes. Wherever there is water the geese and ducks abound, and all along the seashore the ducks were a striking feature of the bird life, often occurring in flocks of from fifty to over one hundred, sitting on the water twenty-five to fifty feet from shore, patiently watching for their meal of small fishes, etc.

About four we reached the tiny seaport of Cabo Rasso, where we laid in provisions, now much-needed, for it had taken three times as long as we expected to reach this place. Coming in Billy shot a flamingo which I skinned out after

supper, but before breakfast a cat sneaked around and ate its head off, ruining the skin. These southern flamingoes are seen about every pond and along the seashores where it is at all sandy. As they rise showing the bright pink and salmon of their wings, they make a very welcome addition to the scenery, where a bit of bright color is so conspicuous.

All the next day the mud and ruts in the long up-hill trail held us back, so that instead of making the Estancia Marciege, we were overtaken by darkness and had to camp beside a shallow mud puddle in the road; which, however, gave the horses enough sweet water for a drink, and to us the basis for tea.

Just before noon on the following morning we came in sight of the *estancia*, and as we came up to the gate, the wind suddenly took Turner's hat and blew it into Paddy's face. This was too much for Paddy, and he jumped so high and quickly that he threw his rider, Shumway, whose foot was caught in the stirrup, so that he was dragged. Fortunately the sole of his shoe came free from the upper, and freed him after twenty-five or thirty yards, but the experience shook and bruised him a good bit, and scared the rest of us thoroughly. No serious harm having resulted, we went on to the house, which proved to be the headquarters of a large German ranch. They cordially invited us to stop for dinner, the good cheer and wealth of which renewed our youth greatly. Upon our proposing to start along, our host insisted that "it was intirely against the custom of the country to travel on Sunday." It was not hard to convince us, and we gave the rest of the day to the enjoyment of seeing a well-planned sheep ranch. There were some thirty leagues inside of a "ten-wire" fence which effectually kept the sheep in and the guanacos out. Yet they estimated that there were still 1,000 guanacos inside the fence. The previous year, they had tried offering a bounty for their extermination, a peso (40 cents)

for each skin, for they estimated that each one ate as many as five sheep. Many were killed and a big pile of skins sent up to Buenos Aires to sell, but they only realized about 25 cents on a skin, so they had temporarily stopped paying bounties.

Next morning our horses acted like new ones, and we proceeded rapidly, coming about noon opposite a large *laguna*, where we stopped a day to collect plants, skins, etc. After lunch each man took a different direction, bent on getting some sort of game. Late in the afternoon when all of us except Shumway had come in, we heard him hallooing so vigorously, that we knew he had shot himself or something. It proved to be a guanaco which he had dropped a couple of miles out from the camp. Taking a tent pole along, we all went out and saw a fine young buck guanaco, looking slender and graceful even as he lay. It did not take long to eviscerate him and tie him on the tent pole. Then I went to catch the horses and feed them before it grew dark. Finishing this I went out to see what had become of the boys, and found they were toiling along a few rods at a time, swearing that the guanaco was not slender but "as big as an elephant." Finally he was in camp, but it was too late to do more with him, so he was put in the wagon for the night and we got supper and turned in. Next morning we took off the skin for a museum mount, and cut up the meat which amounted to about one hundred and fifty pounds; and by hanging it up to cool every night and wrapping it in burlaps by day it lasted us for a fortnight, tasting very much like venison.

These animals, appearing much like antelopes except for their long necks, are the South American representatives of the camel family, and in herds of from ten to fifty range all over the Patagonian pampa. The Spanish conquistadors found them domesticated among the native tribes along the Andes; being used, under the name of

llama, as beast of burden, but they have been replaced for this purpose by the burros. While the hair of their near relative, the alpaca, makes valuable cloth, that of the guanaco is so short, wiry and tangled that it is useless. The skin makes a weak irregular leather, so as yet no good use has been found for the animals. In December and January they drop one or two long-legged fawn-like young, which follow the parents from the beginning, but of course cannot run so fast: so during the first fortnight they are easily run down by men and boys on horseback, and killed with clubs. The skins of these young being thin and the hair soft, have a much greater value than those of the adults, and eight to ten of them are sewed together to make a very pretty, light and warm blanket. These are much used by the natives, and are also sent to Buenos Aires where they are displayed in the windows of all furriers. The finest robes, however, are made by the Indians from the skins of unborn young.

The day was spent getting and pressing plants, skinning birds and collecting lichens. We did not get any water fowl, however, as the wind was so strong that it made the lake too rough for them to settle on it. We also collected one of the large bird's nests made of thorns. We finished by collecting a series of stones from the surface of the pampa.

The whole top of the plain is covered with a layer, two to fifteen feet thick, of water worn pebbles, which looks very much like beach shingle, and by geologists is generally attributed to the whole southern pampa having been recently submerged beneath the ocean, and then having risen again so that this is the last deposit made on it. There are many places near the shore, where today one can see beach after beach, each a little further from the water, showing that the rising of that country is still in progress. The broad spread of this top layer of shingle is unique, and its regularity and thinness indicate that

the rise has been rapid and uniform. The pebbles are of all sizes up to a foot in diameter, at least three fourths of them being various kinds of trap, of different colors, red, black and brown, and of all sorts of texture.

Where they have lain on the surface they are as pitted as though marked by smallpox, and remind one of the surface of a meteor, which, as it came hurtling through the air, has by the friction and unequal resistance of the surface been unequally melted and pitted. On these stones the reverse has been the process, for as they lay on the ground, the wind carrying fine sand as an abrading material has worn on the surfaces, the softer feldspar crystals yielding most, leaving the top covered with hosts of pits. On some of the larger and less movable stones, even the direction of the prevailing winds is indicated by the wear in the surfaces.

After packing two boxes of the material we had gotten together, we hitched in next morning and started for Camerones, which proved farther than we had expected, so that it was just getting dark as we pulled in. Like so many of the coast towns the place is wholly without water, except such as can be caught in cisterns, and this is used only for drinking purposes. So carefully is it cherished that though it had recently rained, they would not sell us any for our horses to drink, but directed us to a pool "half a mile outside the town." In the dark we could not find this, until we subsidized a small boy who led us a good two miles to the nearest drinking place. Finally, however, the horses were watered and fed, and we went to the hotel of the town. Camerones is one of the larger port towns, having a population of some 200. Here we appreciated why it cost 45 cents to get a shirt washed, and even then it looked as if it had been done in a pint of water. Next morning we shipped our two boxes to Buenos Aires; but while they got that far and into the hands of the steamship company for the United States, that is as far as we have ever been able to trace them. We also got provisions, hav-

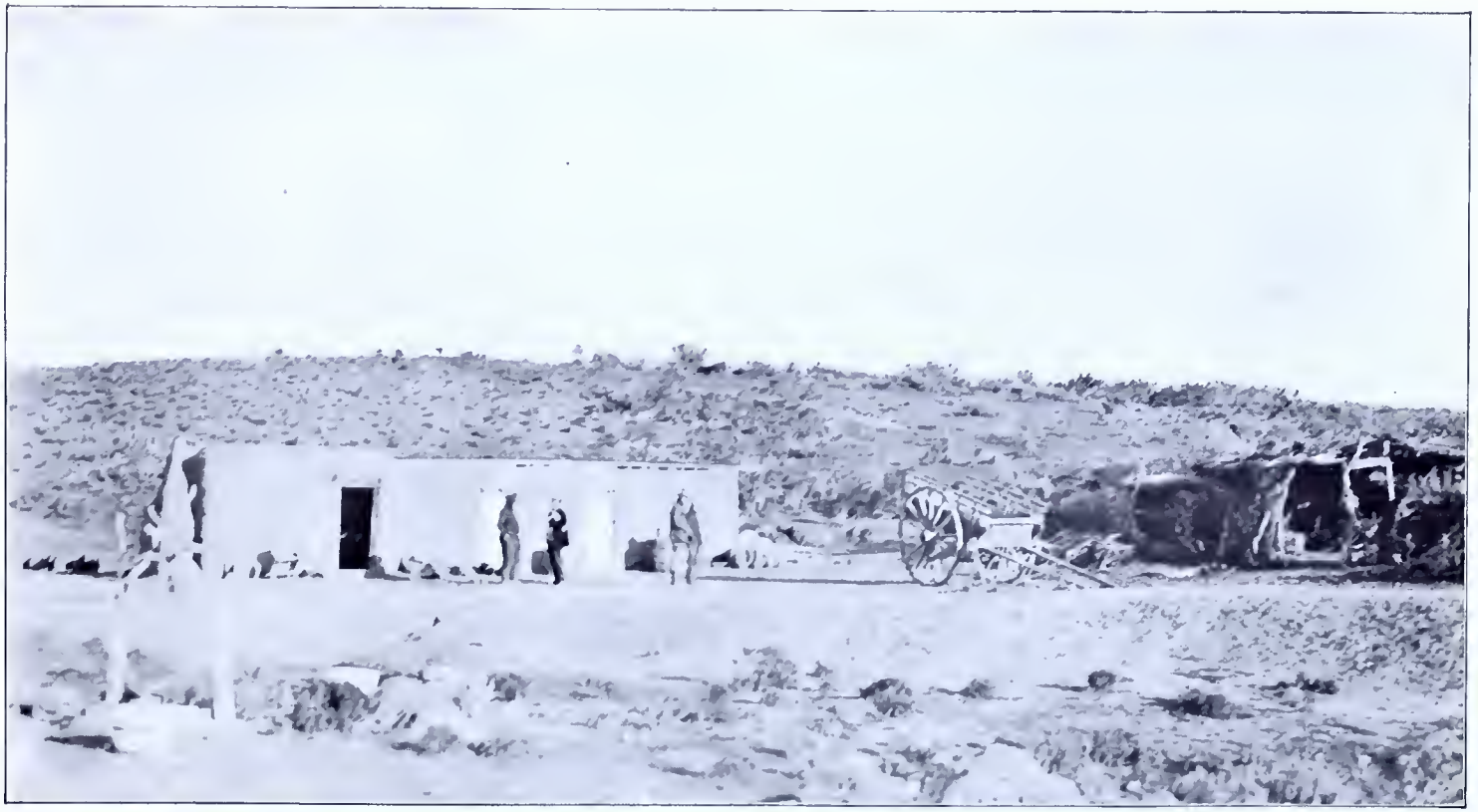
ing to pay ten pesos ($4.30) for a 100-pound bag of oats, the most they cost anywhere on the coast. Potatoes were 25 cents a pound, bacon 50 cents and canned fruit 40 cents a can. These were typical prices for food, practically all of which is shipped in from foreign countries.

CHAPTER IV

Difficulties of Wagon Travel

From Camerones our trail led back inland again and we had another long uphill pull. About noon we overtook an old pedestrian who joined us for the rest of the day, having walked already over 700 miles and being bound for Comodoro Rivadavia or beyond, according as he could find work. The houseless pampa is a poor place for a man without a horse, and this one told us of many nights when he had had simply to crawl into a bush and shiver until morning, then after drinking some *maté*, journey on. The next days were simply push for distance; on the second of which we made the best record to date, thirty-five miles, bringing us to *casa meyer*, the house of Meyer, a little store by a poor harbor, where, however, we were again able to give our horses a good feed of alfalfa, though it cost $2 a bale. We also bought another bag of oats, this time for seven pecos, but on opening the bag the contents proved to be barley.

Next morning after getting directions we started off gaily, but after three hours, found ourselves on the tip of Punta Malaspina at the end of a blind trail. Riding ahead to find some road I took my first tumble, going neatly over my horse's head, as he stopped suddenly in the midst of a gallop. There was no alternative but to turn back for three or four miles to a small fork going inland. We nooned at the fork, and after lunch pushed ahead on an unknown road. Toward night it began to rain; but there being neither grass nor water, we had to keep going, until just before dark we came upon a sheep herder's hut. Asking if we could stop by his water, he said "surely, come in and have supper with us." It was one of the small mud-walled *puestas* with a fire in the middle of the floor. We enjoyed



A Typical Herder's House on the Pampa

the ever-ready *maté*, and watched the roast of mutton sizzle before the glowing embers. Finally it was ready and the seven of us (there were three men in the hut) did not leave much of it.

After a long and decidedly broken chat during which the herder told us he knew about North America where Washington and Lincoln lived, and got out a little geography which said so, they invited us to bring in our beds, throwing sheep skins on the floor for us to unroll them on. The boys and men had the general room, the beds covering the entire floor, so they put the dog outside. He, however, protested loudly, but the door was shut on him, and, not being able to get in where it was warm, he had to be content with sticking his tongue in through the crack, and getting what sociability there was in that. As chief I was invited to share the old man's room with him. Being among strangers and carrying considerable money, when he was not looking I slipped my billbook under my pillow and hung my coat in a conspicuous place. The old man had heard of Americans, and when he thought I was not watching, slipped a big two-foot knife under his pillow. Then I saw that he was as afraid of me as I of him, and turned over and went to sleep. Next morning before starting we photographed our host and his house, the first photographs he had ever seen taken.

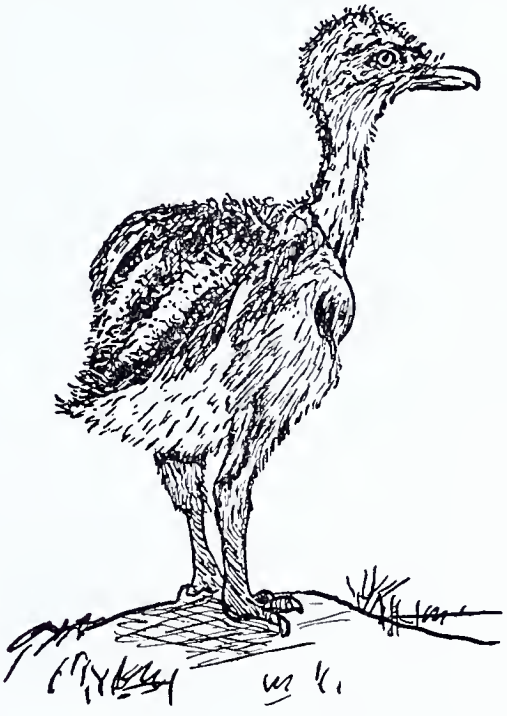
Then we started on what proved to be the crookedest and worst trail we experienced in the country. Eight or ten miles out, after building a fill over a deep gully, and having plunged down one slope over the gully and up the opposite pitch in a manner of which we were proud (though in the process we pulled out the last ring in one saddle which was capable of holding a rope), we met a horseman who told us our road was worse ahead. He was right, for the trail, even then obscure, soon broke up into several single wagon tracks and by night there was no trail at all; but it had brought us into another good bunch of exposures, and

night saw the wagon perched on the edge of a deep canyon, or draw, in the bottom of which there was a small pool of sweet water.

Here we stopped for two days. The exposures drew us far from camp. The first surprise came in finding a nautilus and some marine shells in what we had all along been prospecting for land deposits. Otherwise it was poor collecting until we came to the big bluff which paralleled the coast some eight miles inland. Here accompanying the Patagonian oysters there was a bed of finely preserved shell of many varieties. We had failed to realize our distance from camp, so that when Shumway and I got in it was already dark and Turner was out hunting for the horses. We had seen them in another direction, so I took ropes and started back to find them in the dark, which after some delay was accomplished, by first catching one, and letting him go to the others. Coming back I found a search party out for me on the supposition that I had failed to find the way back.

Next morning the others took the saddle horses out to the escarpment, while I, with the barometer, measured and diagramed a section from the ocean to the top of the escarpment. We got a good set of shells, and Billy found a thin layer fairly crowded with various kinds of shark's teeth, crab limbs, and marine shells, this again where we were looking for land deposits. However, we were glad to get these indubitable indications of the origin of these beds. While crossing over one of the ledges, I ran upon an ostrich nest containing seventeen eggs. This was on the twenty-sixth of September. There was no true nest, only a slight depression in the bare ground with a few feathers and bits of grass for a lining. The eggs had apparently been laid several days before, and had been chilled by the last rain, so that they had been deserted. Two were broken and bad, but the others were all good, and made a heavy load (added to our fossils) for two of us to carry into camp.

In this neighborhood we saw many ostriches as they are generally called, though they are really rheas, differing from their near relatives, the African ostriches, in having three instead of two toes, each with claws instead of nails, in the head and neck being fully covered with feathers, and in the lack of tail plumes. They were usually in bands of from four to ten, and in spite of their large size (about four



Young Rhea or "Ostrich"

feet high) were surprisingly inconspicuous; for until they moved, they were so like the background in color that they were invisible, even when not over one hundred yards off. They were always shy, and as soon as discovered, made off with a lumbering gait which, though clumsy-looking, was swift, and could outrun a horse in a straight race. Billy tried them on Blackie who was a fast horse, but he could not keep up. In hunting them advantage is taken of the fact that they run in wide circles, and are obstinate about

being turned, so that one can cut across their course and get fairly near them. The natives kill them and eat the heavy flanks, which, while not over tender, are very palatable meat. The feathers of this species, Darwin's rhea (found only on the Patagonian pampa, and one of the three kinds), have little value, selling for less than 40 cents a pound, and used only in making up artificial plumes.

Several female birds lay in one nest, depositing from twelve to thirty eggs. These are incubated forty-two days by the male bird, which may, however, leave the nest during the warm part of the day. After the eggs are hatched it is the male bird again that broods the young and leads them about in search of food. In late November and early December we saw several of these broods of young acting very much like young chickens. While all the eggs that are expected to hatch are laid in nests, many single ones are left scattered about the prairie, and during September and October every rider expects to pick up eggs to add to his larder. Each female is said to lay at intervals of three days, and probably lays in more than one nest. The laying period covers about two months.

An average egg is 3 3/4 by 5 1/4 inches in diameter, or 11 3/4 by 13 3/4 inches in circumference, a rather light bluish-green in color, the contents appearing much like those of a hen's egg, and being equal to about seven of them in bulk. When cooked we found the white did not coagulate as densely as that of the hen's egg, but remained more gelatinous. The flavor is rich and does not differ materially from the familiar egg. We blew the contents out of the shells, which latter were saved for the museum, and had a series of breakfasts of scrambled eggs, two at a time, until Billy concluded they were too valuable to be used so recklessly and made the remainder into "powerful johnny cakes."

That evening a native came into camp and laid out a course for us which in four leagues (twelve miles) should

take us to Port Visser, so the next morning we leisurely packed a box of the specimens we had collected here, and started at about nine across the country without a trail. After covering some six miles we came to a *puesta* where they told us we were headed right and Port Visser was only six leagues. We were not even so well off as the two Irishmen, who having asked how far it was to a certain village, were told "two miles." After walking another half hour, another query brought the same reply, "two miles." Turning to his companion Pat said, "Thank God we are holding our own." This man pointed out a light buggy track made a fortnight before and told us to follow it.

In the course of three hours this track led to the top of a 200-foot bluff which seemed almost straight down. But go we must, so we tied the brake up fast and also the hind wheels so they could not turn. Then Billy took the reins and started straight down. It made our hair curl to see the wagon slide, but it landed right side up at the bottom, and we untied the wheels and continued to follow the buggy track. Failing to find any water we had to make a dry camp for the night, eating simply *galletas* for supper. We concluded to watch the horses for fear they would institute a water search for themselves; so Billy and I made a little "Indian fire" and sat over it until midnight telling yarns and occasionally looking up the horses. At that time they seemed to have no intention of leaving, so we turned in. However, next morning they were gone and had left almost no trail on the hard ground. It took us three hours to find them, and then they were feeding by a water hole which their keen sense had located some three miles from the camp.

This was a day of making roads and finding possible crossings over gulches. We passed two or three huts, but they were deserted, the drought of the previous years having made the habitation of them untenable. Finally about three we reached Port Visser, and after two days of not less

than twenty miles each had covered the "four leagues" we had started on. The Port proved to be a small collection of one-room sheet-iron houses where sheep men came in for the purpose of wintering their sheep among the sheltering hills. There was also a store and warehouse. We got corn for the horses and some provisions for ourselves, and started back into the hills to find a pool near some good exposures. Two of us exploring the bushes finally found the place, but it was too late to get the wagon in, so we went back and got permission to sleep in the warehouse, turned our horses out, and spent the evening visiting Mr. and Mrs. Potts who kept the store.

That night was a "howler," the wind doing extra duty, and snow falling at intervals, covering the ground by morning. As we did not hurry about finding the horses, it was after eight before we were on the road; and after leaving this we had three miles of the hardest kind of going over thick bushes four to five feet high to get to our chosen location. However, when the tent was up and the stove started we were more comfortable than the natives in their fireless houses. By noon the snow ceased, and after lunch we all started out prospecting, finding some indications of bones, and a large and handsome section of a petrified tree trunk. That night the water froze by six o'clock, though it was now really summer.

Next morning, Sunday, I started with the wagon to go into Comodoro Rivadavia, about fifty miles from camp, to have some alterations made on the wagon, and to get the mail, more money, and our saddles. The boys had a holiday for the purpose of taking baths (the first place where we had had water enough), and of developing the photographs we had taken to date. Billy accompanied me on the first part of the way in order to furnish an extra horse over certain hard places. Going first into Port Visser we found out about the tides, and about eleven started first beside the beach, then dropped down upon it, figuring to

Bluffs where Marine Fossils were found. Trails are those of Guanacos

Guanacos on the Pampa

go some fifteen miles along it during the low tide in order to avoid a sixty-mile detour inland. The first eight or nine miles on the beach were through loose soft shingle where the horses sank to their hocks at each step. This was the critical part, for there the tide rose ten feet to the foot of the bluffs which in this section rise directly from the water; and once started one must make through this stretch during a low tide. Billy helped me beyond what is known as the "danger point," then returned, reaching camp about eight in the evening.

From that point there were some eight or ten miles of fine hard sand, which, when the tide was out, made a fine drive; but this sand was curious in appearance, and was referred to as the "glistening sands," there being always a film of water over them. As long as one kept rolling the going was of the best, but if one stopped for a few moments, they acted like quicksand. Over this the wagon rolled rapidly until about five, when I found some running water and drew the wagon up above high-water mark, fed the team, and placed them in a ravine to pick up what they could. Then I made a fire on the beach and got a simple supper.

With a full moon and a clear sky overhead, the roaring surf on one side, the towering cliffs on the other, a warm night, a driftwood fire with its colored flames, and the knowledge that there was not a soul within tens of miles, it seemed a pity to sleep at all. Finally, however, after looking after the horses I unrolled my bed in the bottom of the wagon box and turned in. The tide was low at about four in the morning; so before light the horses were caught, fed, hitched in, and by five we were on the road, in time to see the sun come up out of the ocean with all the colors of a famous sunset. All over Patagonia both the rising and setting of the sun are accompanied by the most brilliant color effects I have ever seen. After two hours on the beach we turned off and took a good though hilly road

which in twenty-five miles brought us into the widely known town of Comodoro Rivadavia, chief business center for all the coast.

Coming in I was fooled, however, by what seemed to be a rather large town with boats in the offing, which proved to be the railroad camp three miles from the port proper. This camp is a well-built place with many large buildings of sheet iron, car shops, etc., and the terminal for the railroad which on the map goes clear to the Cordilleras and connects with other lines going to all parts of Argentine. But the railroad actually goes forty miles inland and stops in the open country. It has taken five years to get this far, and when we were there work had ceased with no indication as to when it would start again. A train of two or three cars ran once a week over this stretch but has not yet begun to carry passengers. It is a government line, well built with wide gauge, heavy rails, and ties of *quebracho*, a much vaunted wood, which in such positions and as piles is supposed to last a hundred years or more, each tie costing two to three dollars when in place on the railroad. In the engine house were engines enough for several trains, an engineer's track automobile, and even three sleeping-cars imported from the United States.

To get out of this place one had to go up over a big hill on a well-laid road that had been built to avoid going a mile along the soft beach which was the former custom, and where there was scarcely a day that some big wagon did not get stuck, and have to be anchored through a tide or be lost entirely. It was about one when I arrived, and after a real dinner went at once to get a haircut and shave before presenting my various introductions. First, I saw the alterations on the wagon started, then went to the postoffice and got the first mail we had received since starting. The rest of the day was consumed reading letters and papers, to get a vague idea of what had happened in the world in the meantime.

Next morning I went to the National Bank to draw some money, but in spite of the letter from the President of the Trelew bank identifying my signature, an introduction by Mr. Evans, the manager of the local branch of the Chubut Mercantile Company, my passport, and the Governor's letter, I "was not personally known" and could get nothing. The only possible way was to telegraph to Trelew and order my account transferred to Comodoro, which I did at once. After two days there was no reply and I had to leave without any cash. I had learned something, however, about telegraph lines in Argentine. The regular time involved in a reply is three or four days. The first day the message is put in at the postoffice and lies there until all telegrams for the day are in, when they are all sent. Next forenoon they are distributed. A quick reply might get back to the office that night, but usually it is the succeeding day, that is three days after sending, that one may begin to look for a reply. The telegraph is part of the postal system, and the rate the same for all parts of Argentine, 50 *centavoes* (22 cents) for fifteen words including the address, double if in a foreign language, and treble in code. Throughout this southern section of the country it is very extensively used, as letters take an average of a month to make a round trip, on account of the irregularity of the boats.

My saddles had been lost again, but from my mail I located them in Buenos Aires and sent a set of telegrams about them also. It took all day Tuesday writing letters and attending to errands, and when no reply was in by noon Wednesday I had to leave for the return trip in order to make connections with Billy. Late that afternoon I made the same camping ground as on the way down, and had another fine night, but this time the moon was only three quarters full and the weather not so warm. In the morning I met Billy a little beyond the danger point, he having started at three-thirty in the morning to meet me.

We came through the heavy gravel without incident, took lunch with the Potts, and reached camp in the middle of the afternoon.

The Site of the Fossil Forest

A Petrified Tree Trunk

CHAPTER V

A Fossil Forest

During my absence the boys, while exploring the hills, had come upon one stretch where a temporary stream had cut a deep gulch, and two hundred feet below the oyster-shell layer had uncovered an area a mile or so in length and about 200 feet in width (the width of the ledge), which appeared to be an ancient fossil forest, where tree trunks from a few inches in diameter up to over five feet thick were lying scattered in every direction, while the ground between was strewn with the fragments of hosts of other logs which the frost and weather had shattered. Generally the wood was of the straw-brown color characteristic of modern wood which has lain outdoors some time; and the chips appeared so like recent wood that it was hard to believe it was not, until one lifted it and felt the weight and hardness. Even so, Shumway was not entirely convinced until he brought some home and tried it with acid.

As we went from log to log and saw the perfect grain of this one and of that, here an old stump with its roots reaching out, there a small palm, and in other spots tiny veins of coal indicating small branches, we were carried out of the present back to the different conditions under which these trees had lived. During the whole forenoon we did nothing but go from one specimen to another, and then over them again. Finally, however, we called ourselves back to the present and became collectors once more.

The predominant tree had a close, fine grain not unlike our maple. Others were much coarser in fiber, resembling the pines and sequoias of today, of which type there were no less than three varieties. Two sorts of palms with their pithy stems occurred occasionally, besides a few smaller types which we could not recognize.

In most cases the wood was silicified, each particle of the original wood having been replaced molecule by molecule by silica; so that while no wood really remained, yet every feature, even to the microscopic structure of the cells was preserved. In a few cases the wood was carbonized and black, being then much softer than in the other cases.

The more we studied the matrix, the way the logs lay, all being horizontal, and the curious admixture of kinds, the more it appeared that this deposit was not in the original habitat of the trees, but represented drift wood which had floated down an ancient stream, perhaps like the great rafts which drift down the Amazon and La Plata rivers after the spring rains, finally becoming waterlogged and sinking in the mouth of the river. At any rate the sands in which the fossil trees were buried were of marine origin, and had been laid down near shore in rather shallow water.

Going through we marked some chunks of the various sorts to be taken out for show specimens, and others for study purposes. Then they were photographed where they lay. The next day was entirely consumed getting the wagon as near as possible to the place and bringing the selected specimens to it. The largest pieces we took weighed about 300 pounds, being short sections of tree trunks. We could not take every piece we wanted, however, for each one had to be carried on a man's back down a steep slope, across the gulch, and up a narrow guanaco trail for 150 feet or more to get it to the wagon. In general, a section from each kind of wood was enough, and only a few of the rarer and more fragile pieces had to be bandaged up in flour paste jackets to make them firm enough for safe transportation.

Before we left the country we wrote to the Governor of Chubut telling him of the scenic interest of this locality and suggesting that the land, still a part of the public domain, be reserved as a state park. It will certainly

Camp Near Puerto Visser

become a place to be visited by those who are interested in natural phenomena.

It took us three days to get our specimens into camp and packed, and to make a section across this exposure. Then we had to shoe one of the horses. While doing this we heard there was a man over on the Chico River who had found a "bone." That was exactly what we most wanted; so on the morning of October 10, we put our boxes into the wagon and hauled them into the port, leaving six in all to be shipped to the College. We also took in every bit of baggage we could do without, temporarily reducing ourselves to the clothes we stood in and our beds; for we planned in ten days to come back this way, and the pull up on the pampa was reputed hard. Then we bought provisions, the major part of which was 500 pounds of corn for the horses, and a Spanish saddle or *riccao* for the Paddy horse. All this was hauled out to the fork in the roads, where it was made into a neat pile and topped with a rubber coat arranged like a scarecrow to discourage any range animals from investigating our cache.

Crossing the bushes we found the boys had struck camp, so after an early lunch we were on the road again. When the stuff at the cache was put on, we found we had a good sized load in spite of what we had left. We made a short day's run, but were all ready for an early start in the morning. About here the country was so broken that the road twisted like a corkscrew to keep whatever it gained in height. At noon we were just under the last pitch of some 500 to 600 feet which led up on the plain. As at this level there were likely to be springs, most of the houses in this section were situated in the various ravines at intervals of from five to ten miles from each other. Wherever there is a spring there is usually from one to five acres of boggy ground covered with good, though coarse grass.

From here the real pull began, for what was left of the

road made a frontal attack and went right up on the pampa, without attempts at zigzagging or winding. During this we had a chance to try out the *riccao* as a working saddle. To us a saddle of this pattern looked strange; for it consists of two pads to lie either side of the horse's backbone, over which is laid a blanket, then the cinch, and above that usually a sheep's fleece fastened with a small strap. When the rider gets on top, his knees stick straight out on either side, and the stirrups are used merely to balance him. When initiated, however, they are fairly comfortable, and the gauchoes are certainly expert horsemen, also using the lasso from this saddle. On an American saddle, the saddle horn is used for attaching the end of the rope, but in these there is a ring fastened to the cinch and the rope is passed through this, the horse pulling from the side; and they certainly seem to get the same amount of force into the pull as from our type of saddle.

It was a luxury to be again on the level pampa, after the days of struggling through the broken country below, and we rolled along the big north and south trail with ease. This lasted, however, for only a few miles, until we should find certain buggy tracks leading west. Before we were really there, we lost a couple of hours through misunderstanding our directions, and trying to find the place where others had left the trail, so we camped for the night on a small and rapidly drying *laguna*.

By nine next morning we were at the edge of the eight or ten-mile wide valley which the Chico River has cut 800 feet deep through the pampa, and were looking across its grand canyon, with the innocent looking little brook at the bottom, a stream quite out of proportion to the valley, which latter had a dignity worthy of a river the size of the Hudson. In the past the stream must have been much larger, though the material through which it has cut is mostly soft sandstone and clays. I confess that as I looked across this valley, in spite of its scenic grandeur, I was

decidedly gloomy; for the same beds we had explored for two months were repeated here, in the same order, and about the same thickness, and there was no indication that we could expect anything new to turn up. The others even rallied me on my long face.

However, we began the descent (much easier and faster than the ascent), and soon came to a small house made of adobe bricks. It belonged to an English-speaking Boer. In another hour we saw a similar house, and found we were in the midst of the Boer Colony. It seems that after the war, some 600 families of Boers, many of the heads, men who had been prisoners in Bermuda, and all men who had been active in the campaign, rather than return to Africa, had moved to Patagonia where they obtained from the Argentine Government a tract of land on the upper Chico River. Each man had received a league of land for 2,500 pesos, on condition that he live on it and make certain improvements, namely a house, a well, some fence, etc. After three years he was to receive a title, and begin paying instalments on the price. So they took their families and moved here, and have made some of the best settlers in the country, for they were used to frontier life, and to sheep. Then their standards of living are high, their houses being built mostly of sun-baked bricks, neatly finished inside, with floors and attractive fireplaces, so built that the fire is on about the level of the floor, and either side is raised to make shelves where things can be placed to keep warm. There are always some books and pictures about. They are a people who have considerable religious training, straightforward in their dealings, and very temperate. These big fellows all tell you they are not strong enough to drink whiskey.

They have been there six years now, having come into a country entirely unsettled and without roads, and have built their houses, roads and considerable fence. When they came most of them had to camp in tents, and live on

what guanaco they could shoot; but if a man had a little he loaned his neighbor, they traded work and spent little. Now almost every family has 10,000 to 20,000 pesos worth of property in sheep, buildings and land. We found them a delightfully hospitable people, very like our own western frontiersman.

We finally came to the house of Booysen, the man who had found a bone, but he was out shearing sheep. I went to his pens and found him, asking in English where he found the bone. He did not understand English. Then I tried my Spanish. That was the same. Last I tried German, thinking it similar to Dutch. No use. Finally I told him we were from New York, and that was the key, for then he spoke English all right and could understand German. After a bit he pointed out the *kopje* some three miles off where he had found the bone, "but it was no good, for it all fell to pieces." However, Billy and I rode out to look over the lay of the land. After we got upon the hill it did not take half an hour to be sure that the point for which we had been seeking for over two months was before us. In that time I grew at least fifteen years younger.

The hill was a mesa-like table, not over half a mile long, and constricted nearly to breaking in two places. The material was sands of varying grades of fineness, laid down in beds, some slanting this way, some the other, cross-bedded, which is indication of a river deposit, the bedding indicating the shifting bars, etc. In the sands were fine particles of worn bones, and occasionally a whole bone, a jaw, or, as we found later, a skull. Some of the beds were predominantly coarse sand, others sandy clay, and here and there thin bands of volcanic ashes. The contact at the bottom of the bed was of the most irregular sort.

We stood where a great river had flowed two million years ago, or thereabouts. In and about it the animals drank and wandered. Some died or were killed here, as happens today. Their bones lay on the bank or in the

A Boer Family and Homestead

The Fossil Hill Showing the Cross-bedding

water, and at flood times were buried in the river deposits. In time the whole area sank; for near the top of the hill was the oyster layer, with all the indications of inundation, irregular contact, disturbed beds, all sorts of shallow water shells, bones with borings of teredoes, etc. The sinking continued until after over 500 feet of marine sands were deposited on top of the river-beds, then the land rose again until it now stands 800 feet above the sea level. The Chico River has carved out the hill, reëxposing the bones buried so long before.

The afternoon waned and we hurried back to the boys who had begun to wonder if we were lost. The nearest water was close by the house, and Mr. Booysen allowed us to camp in his dooryard. Next morning we all went over on foot and began real prospecting. Inside of an hour every man had a prospect to work on, and before the day was done he had enough work in sight to last him a week.

For three days we worked from this camp, but as we were going over the third morning Billy spied a bare spot where the ground was damp and covered with a rime of salt. It looked as if water might be underneath, so we got the pick and shovel, and a couple of hours digging cleared out what proved to be as good a spring as we encountered in the country; so the next morning we packed up again and moved over to our spring where we could camp within half a mile of our hill.

CHAPTER VI

Collecting Extinct Animals

For over three weeks we camped here, one day being very like another. Our routine began at a quarter before five, just before sun-up, when Billy called, "roll up your beds, boys!" (He had been out since four, having a tiny buzzing clock which we termed the "rattlesnake" to wake him.) It took but a few minutes to crawl out of our beds and resume the few articles of clothing we could spare at night, and to wash in our special pool. We had made a series of water holes, the first and main one being sacred to the water buckets, even these not dipped in, but filled with a cup, the second for the horses to drink from, and the last for washing. This last was a hasty operation; for in the morning the water was like ice and the stove much more attractive. Breakfast was at five and a hearty meal; after which Billy and one of the boys straightened up camp, while the remaining two of us started out to find the horses, which were usually feeding a couple of miles from camp. After bringing them in, feeding them, and turning them out again, everything was ready; so that by seven we closed up the tent and started for the hill, each man with his pick in his hand and a bag on his back, containing hammer, chisels, awls, brushes, cloth for bandages, flour, shellac, and a canteen of water; also his lunch.

To find specimens one climbed around on the face of the hill, until he came upon some fragment of a bone, which had been weathered out and perhaps rolled down the hill. This was traced upward until the bone from which it and perhaps other fragments were detached, was found. This, technically called a "lead," was carefully uncovered to ascertain how much of it was there, and if enough were pre-

"Roll Out," 4.45 a. m.

served so that it would ever be possible to determine what sort of an animal it represented. At this stage it was then called a "prospect," and serious work was begun on it, the first attempt being to expose enough to determine the extent of the find. In these beds the bones were without any infiltrated filling, so that, while perfect in form, they were soft and fragile. To remedy this a coat of thin shellac was applied and allowed to soak in, then a second and third and often more were put on, until the matrix and bone ceased to take up shellac. In the end by this means it was hardened. As soon as this was complete, strips of cloth were torn, dipped in flour paste, and adjusted to make a firm bandage. When dried in this stage the whole should be firm enough to work around, and the adjacent rock was gently removed, leaving the specimen on more or less of a pedestal. More bandages were adjusted and dried, and finally it was ready to undermine and turn over, the same processes being repeated on the underside, the result being a package which was firm enough to pack in hay and ship. In general, the preparation of a specimen took about three days, other prospects having been found and started in the meantime.

At noon we made a point of all getting together for lunch; for many of the cases required a consultation, first, as to whether a given lead was of any value, and second, as to the methods to be used in getting at, dividing up, or turning over the more complex prospects. After a lunch of bread and cold meat and if lucky a raw onion, inasmuch as the tension of continually working around a specimen that is liable to collapse at any moment tries one's nerves, we usually relaxed a bit by going up on top of the hill where the oyster beds were exposed, and searching for the small marine shells, shark's teeth, etc., which accompanied them here. At this point the oysters occurred in typical beds, so that when weathered out the whole surface was strewn with the shells and their fragments. Something in the

preservation of the oysters themselves, however, had made them so friable that we could not handle them without their going to pieces; while the other shells being of slightly different composition were preserved intact. This was a contrast to our experience elsewhere. On other sites it was the oyster shells which were solid while the others were powdery or had been completely leached away, leaving only imperfect impressions.

About five in the afternoon we had to quit, and each man made for camp carrying whatever he had finished during the day. Again the horses had to be hunted up and fed, after which we were ready for our seven o'clock supper, always the chief meal of the day. This eaten, we turned to and catalogued the specimens, giving each a number, and making a record of the place where found and all accompanying conditions. We seldom found it too early to turn in soon after this, each man seeking out the particular spot among the bushes where he had placed his bed. One feature of the nights struck us particularly, and that was their stillness. In the western United States one listens to the weird calls of the coyotes as a part of the experience, but here there were neither canines nor birds to break the quiet, the little foxes being entirely silent, and the night birds lacking.

For over a week we came and went without incident, our finds varying from skulls of rhinoceros-like animals down to the jaws of tiny rodents the size of a mouse, but related to the cavies of which the Guinea pig is the best known representative. From the first we began to find tiny jaws belonging to marsupials, suggesting similar ones found living to-day in various parts of Australia. There were also numerous animals the size of a sheep, but with heavy clumsy bodies and biting teeth in the front of the jaws, a group now entirely extinct; and numerous bird bones, varying from small flying forms, to long-legged, long-billed, heron-like birds, and one in particular a big running bird

over eight feet high. Most of the remains seemed to have been pretty well scattered, as though the carcasses had been pulled to pieces by the carnivors of that earlier time. Day by day our pile in the tent grew and began to crowd us into the corner.

On one of the ledges we came upon a large buzzard's nest containing two eggs the size of a hen's egg, but covered with spatters of brown color. The old birds made a great fuss about our being on the hill, until one noon when they were off Turner climbed down to the nest and collected the eggs, after which the birds left the hill to us.

On Sunday, the twentieth of October, Billy took Blackie and rode off to the south, while I mounted Colorado and went west across the river, to look over the excellent exposures on these sides of us. Reaching the river I found it small but with a poor bottom, so I had to ride a mile upstream to where a gaucho showed me a crossing, and we made the passage, though Colorado had to swim a bit. On reaching the top of the bank the men insisted on my coming in with them and having lunch, for which they scrambled an ostrich egg from some twenty which they had piled in the corner, and told me that some great bones were to be found in the adjacent bluffs. These may not have been mythical, but I was unable to find even a trace of a bone fragment, and kept going from one exposure to another until mid afternoon, when we stopped so that the horse could pick up a little grass. Finally we started back by a new route to cross still other exposures, but unfortunately they were barren of fossils. Being anxious to get across the river before dark, we pushed along at a hard pace, bringing out the fine endurance of my horse, which I had not before realized.

Just after crossing the stream I ran upon the nest of a martineta, a bird very much like our partridge in appearance, and the common gamebird of the country. They live entirely on leaves, seeds, and grass and go about in

flocks of two to ten in number. When flushed, they seldom rise but run and hide behind the bushes, usually escaping in that way; but if followed up they then rise noisily and fly a hundred feet or so, being rather weak on the wing. They are of especial interest because in their relationships they are intermediate between our northern game birds and the ostriches (both rheas and African ostriches). The nest was simply a depression in the ground under a protecting bush, and contained ten dark green, thick-shelled eggs, which I tucked into the front of my shirt, and which were later made into johnny cakes.

It was a good deal after dark when I rode in, and found Billy just pulling the saddle off his horse. He had had the same sort of day as I; fine exposures everywhere but no fossils. While we were away Turner had gone to the nearest ranches to try and get more burlap or any cloth to be used for bandaging our specimens, as the twenty-five yards we had brought was gone. He brought in very little, so we dedicated Billy's coat, Shumway's pajamas, Turner's towels, and one of my blankets to the continuing of the work and made plans to finish up by Wednesday night.

Monday noon, Shumway reported a curious lead, which he wished passed upon to see if it were worth taking out. It appeared to be a rib, but soon developed into a skull, and when we got to the teeth, proved to be the almost unknown Pyrotherium which Ameghino had found and claimed was a member of the elephant family. As we worked the specimen grew, until we had uncovered a skull thirty-eight inches long, with tusks in the upper jaw fully ten inches in length. Near by we found the lower jaws each with an eight-inch tusk in front. The dentition certainly did look like that of the early elephants. The skull suggests the ancestral elephants found in the Eocene beds of the Fayum desert in Egypt, though the teeth are much more advanced in their development. The very short neck-vertebræ were also with the skull, and scattered

Shumway Working on the Pyrotherium Skull

Searching for Sharks' Teeth in the Oyster Bed

through the same layer but not immediately adjacent were numerous limb bones which seem to belong to the same form, judging from their excessive size and general elephantine characteristics. This was the first time more than teeth of this form had been found, and things grew exciting; so our date for leaving was set ahead three more days. Next day Billy found another smaller Pyrotherium skull, and three other sorts of skulls; then Shumway located a pair of jaws and the limb bones of a small animal which has all the appearance of being one of the early horses from the Eocene of North America. We then gave up fixing a date for closing work.

During these days the horses began to bother us by wandering off. The first time was Monday afternoon, when we searched until dark and then returned to camp to find that they had come in of themselves. Next morning they were four miles away, and that night we did not find them at all. Wednesday morning they were five miles away, and when they have to be located by tracking them it takes a great deal of time. This sort of trouble is typical when traveling in such a country, where every second man one meets, asks if you have seen a red, white, or black horse with such and such peculiarities.

When it was evident that we still had a week's work ahead of us, we loaded all the specimens in camp into the wagon and Saturday morning I started for Port Visser. For the first four miles we made a new trail in order to escape the heavy sand on the first slopes of the hills. With the wagon box full of fossils it was slow traveling, but I made clear across the pampa and camped on a spring under the further side, reaching the Port about ten the next morning. The rest of the day was occupied stowing away my stuff, getting new supplies and visiting, during which I agreed to sell Mr. Potts my wagon and harness, to be delivered in Comodoro Rivadavia when we were through with them.

With an early start Monday morning I pushed clear across

the pampa into camp in one day. During the afternoon, as on all occasions when traveling this road, I drank tea at three houses, coming to the second Ventner place about four o'clock. Next morning we learned that since the previous day about six p.m., this Ventner family was richer by a son; so we immediately sent over our congratulations and invited the father to celebrate by dining with us on Wednesday.

During my absence events had succeeded each other rapidly. Sunday morning the saddle horses had disappeared. While the boys were hunting them, they came upon a guanaco which they killed, and spent most of the day skinning it and then stripping the flesh from the bones so these could be mounted for the museum. The horses still failed to turn up, so Monday morning Shumway and Billy started out on foot to find them. First they called at various neighbors to see if they had seen them, but learned nothing. About ten they struck their trail, and followed the tracks until four in the afternoon, when they came up with the horses in the midst of a mixed bunch of mules and colts. The boys came in with the horses just after I got to camp, and they looked pretty well tired out. However, the outfit was all together again, and we picketed the horses for a few nights, on the principle that "it was better to count their ribs than their tracks."

Sunday afternoon Billy had come into camp with three armadillos (the small *pichis* of Patagonia) hanging by their tails, all three of which he had caught within twenty paces. Two of them we skinned, and roasted the third. The natives call them good eating, and we saw numbers of the bigger northern species for sale in the markets of Buenos Aires at three to four pesos each. The method of preparing them is to open the body and remove the viscera, then stuff the body with a bread crumb filling and roast the animal slowly in the ashes. They are full of a rich fat, which gives the stuffing an excellent flavor, but there is very little meat on the numerous bones. Whenever we

saw armadillos we always gave chase for the fun there is in it. They would make under a bush and begin to dig, and do it so fast that before one could dismount they were disappearing in the ground, but we could generally capture them by getting hold of the tail and pulling them out again, though they sometimes got away by getting into the midst of bushes that were too thorny for us. This smaller species is confined to the pampa northward from the Santa Cruz River as far as the Rio Negro, beyond which live the larger species, called *peludo* or the hairy armadillo.

Wednesday came and with it Mr. Booysen with half a sheep on his saddle which we had purchased for 80 cents. While Billy got up a special supper, we took the men over to see the prospects on which we were working, and incidentally learned from them a good deal about the Boer Colony. The people had then been there for six years, and their families were getting where the education problem was confronting them. There was no church within 300 miles; the nearest school was 75 miles away; the only doctor was at Comodoro Rivadavia 75 miles off, and cost $150 a visit beside the transporting him out and back. The treeless country, the harsh winds, the lack of all social opportunities, were especially hard on the women; so that up to that time nearly a third of the original colony had already returned to the Transvaal. Then the requirement that they take the oath of allegiance to Argentine, and the unlimited delays in granting titles to their lands (at that time not a title had been perfected) were making the men restless, so that as fast as good opportunities to sell came, they were cashing in their assets and going back, the which was made still easier by the English Government's having paid indemnities for the buildings and stock destroyed during the war. In some cases I understood that either the government, or societies for the purpose, were paying their passage money back, that being the condition under which I met a returning family on the boat. Finally the Boers understood the English

and respected their fair dealing, which was not true of their relations with the Argentine government: so these men prophesied (and this I heard repeated several times) that within ten years most of the Boers would be back in South Africa. Then we had our supper and pledged the new little Ventner, and our party broke up early, as no one likes to ride this broken country after dark, but not until I had accepted an invitation to ride next day to David Ventner's to see some fossils there.

In the morning we all went to the hill for three hours, after which I took Colorado and rode to the home of Durk Ventner arriving just as the wagon with Mrs. David Ventner (who had been staying with her sister) was starting home. Before they went, however, I had to stop for the tea and a chat. I then started after the wagon, catching up in time to take tea at three more houses before we left the settlements, and went up on the pampa for some ten miles, finally dropping into another canyon where the David Ventners lived.

Going down this hill the driver of the wagon and four mules did some fancy driving, for the wagon brake gave way and the mules went down the hill on the dead run to keep out from under the wagon, and there was no chance to turn off the trail. Finally he landed the whole outfit in a mass of bushes at the bottom with nothing worse than a good shaking up. It was half-past one when we arrived and after a bite of lunch Mr. Ventner took me out "a little way" (six or more miles) to a place where we found another fossil forest, but on a very much smaller scale than that at Port Visser. We collected some samples, and he volunteered to haul a 400-pound section of a fine tree trunk in to Comodoro Rivadavia to be shipped to the College later. Then we went another "little way" to the site of some Indian graves, where a burial of three or four men had been made all in one grave on the brink of a ledge, but it had been opened. There were also just under

the overhang of the cliff other graves where the body had been placed and walled in, but like the first they had been opened. Last we went over to an old well from which a bone had been dug, but did not find a suitable place to begin any operations, and reached the house about half-past six after a full day in the saddle. Mrs. Ventner gave me a fine set of Indian arrow points, etc., which had been picked up about the place. That night I slept in a big four-post bed with four pillows and a lace counterpane.

Next morning after a cup of coffee I started at about five o'clock for camp. Stopping on the way to water my horse I had to break ice on the pool. As I passed I stopped at Booysen's, as he had found two ostrich nests with a total of fifty-five eggs in them, and was willing to sell me ten eggs, which at Comodoro bring 75 centavoes each. By shifting the rocks in my pockets I got one in a pocket and carried one in my hand, leaving the others for Turner to come and get. I got to camp about nine and had breakfast before going on to the hill. During these days work on the hill was very trying; for the wind was so strong that it was almost impossible to stand against it, and in the most exposed places we were forced to crawl on our hands and knees to get ahead at all.

The day I was at David Ventner's, the boys had gathered as usual under the overhanging ledge to eat lunch. As they sat there Billy picked up a modern bone, and began speculating about it. One called it a guanaco toe, but he said it was human and climbing upon the ledge to investigate, found that for three weeks we had been daily sitting six feet under an Indian grave. It looked like a pile of rocks, but under them was a nearly complete human skeleton. When I got back they took me up and showed me the whole collection of bones spread out on the surface, and asked me to settle a dispute as to one bone. It proved to be a third ilium and started another investigation as to the meaning of this extra hip. Going carefully

through all the sand and the adjacent corners of the grave, we got out another extra thigh bone and three surplus neck vertebræ, besides some finger bones. Then on a small mat of dried grass we found the remains of the skeleton of a very young child, probably new-born, as no teeth were in the tiny jaw.

The only interpretation we could put on the conditions found were that originally there had been a burial of an adult Indian man many years ago. At a later period, perhaps a hundred years ago, another group of Indians while in the neighborhood lost a mother and child. The first grave was opened and most of the original bones thrown out (an unusual procedure). New boughs were brought and the body of the woman sewed up in leather clothing, bits of which we found, was laid on them, while beside her on the mat of grass was laid the child. Then these bodies were covered with a pile of stones to prevent pumas or other animals from despoiling the grave. There were no implements in the grave with these skeletons, and the time of the burial was a good many years ago, for the cliff on which they were placed had been worn away by the action of the wind enough to remove a considerable part of the ledge and drop down a few of the bones of the dead. After photographing them, we collected the bones for the museum.

Next morning the ground was covered with a couple of inches of snow which, however, disappeared by noon, but prevented our working on the hill during the fore part of the day. We used the time by all having a haircut, presided over by Billy, and lastly I did his also. Through the afternoon we pushed everything along so as to close up the work on this hill, not because it was exhausted, but we were getting mostly duplicates of the first things found, and especially because we were very anxious to see the country to the south as far as the Deseado River. It

The Indian Grave Just After Opening

Hauling out a Load of Bones

seemed as if the signal for going caused new leads to turn up, and we simply had to say "nothing more."

In the morning Billy and Shumway went to the hill to bring in the last two specimens, though the bandages were still wet, and they had to be packed in the wagon in dishes of sand to prevent too much shaking. By ten we were all packed up, and started up across the new trail we had laid over to Durk Ventner's, where we stopped and had the last cup of tea with our Boer friends, and all went in to see the youngest Ventner of all. Crossing the pampa, we stopped for the night on the spring just under its east edge. Near by was a ranch house, to which I went ostensibly to ask permission to camp, really in hopes we should get an invitation to supper. Of this I failed, so we had to gather wood and get our own repast. It was a delightfully warm evening, and after supper our friend with his wife and children came out to walk about and view the farm (and us). We chatted with him a few minutes, after which he remarked, "if you want to, you can come up to the house and have a talk." We did, and in spite of the form of the invitation, had a good time drinking tea and talking over the sheep, a topic which always dominates the conversation in Patagonia.

The next noon found us pulling into Port Visser, where we obtained the loan of a house to use as headquarters while we packed up our collections. Here we came right up against the lack of lumber. All the lumber in the country is imported either from the United States or from Norway, and costs about three times what the same grade does at home. In northern Argentine there are great forests, but that part of the country has not yet been generally opened up, and what is brought out is used mostly in the neighborhood of Buenos Aires. Then many of the sorts of timber are suitable for building purposes, either being excessively hard, and available only for cabinet work or railroad ties, or being too soft for any construc-

tion work. In place of the lumber we made use of a supply of the boxes in which various liquors had been shipped from Europe. Being strong they answered our purposes in all respects, except shape, and we had to readjust them to fit the specimens.

As to all frontier countries, there is an enormous amount of liquors shipped to Patagonia; and there being no duties to pay, nor license fees, it is both cheap and of good quality. When traveling it seemed as if every third place was a *boliche;* for where anything was sold, drinks were also. Almost every house had about it its host of empty bottles; and the saying was that one could always recognize the nationality of the owner by the class of the bottle, whiskey for the Scotch, beer for the Germans, and vermouth for the Spanish. The problem of disposing of the useless empty bottles was solved in various ways, the commonest being to set them neck down into the ground to make a fair sort of pavement, most towns having several rods of this sort of sidewalk. In two places we saw them piled in tiers and cemented with adobe mud, to make the walls of buildings.

About four in the morning we heard the whistle of a boat, long expected at the Port; so we hustled out, and while the boys went for the horses, Billy and I, making all possible haste to nail up and mark boxes, succeeded in getting eleven ready to go on this steamer. It took the rest of the day to get the remaining six packed, and they had to wait for the next boat, which did not put in for over two months.

We were all invited to the Potts for supper. Shumway and I went out to get the horses but they had disappeared, and it was after dark before we finally located the tinkle of the bell which one of the mares wore. Consequently we were very late, it being after nine when we appeared. They had, however, saved a part of the roast chicken for

Pete and His Mules

Racing with the Tide between Puerto Visser and Comodoro Rivadavia

us, and we had a prime evening in spite of our troubles. About ten Pete came in with the four mules we had hired to help us the next day.

As the tide was not low until noon, we did not start the following morning until nine. Then with four mules hitched on ahead of our team we went down to the beach and began the eighteen miles of plowing through the loose shingle. Just as we were getting away I took a long whip with the commission to ride along beside the mules and urge them along. The first time I swung this whip my horse threw me off so quickly that the whip never reached the mules, but he did not get away and soon learned the whip was not for him. When we got well into the shingle Pete had to take to running along beside the mules, and drove them with the most varied and loudest vocabulary I have ever had the pleasure of hearing. In places the mules made us trouble by refusing to go into the shallow pools of water left by the retreating tide, but by straightening them out from time to time, we made fair progress. In places we came upon small bunches of the southern penguins sitting on the rocks so stupidly that Pete knocked one over with the long whip which he carried, and could have done so right along. About three we pulled off the beach and fed the horses. Here Pete said good-bye, and after standing for his picture, disappeared with his mules on a full run to get back before the tide should cut him off entirely. We only went five or six miles further, camping for the night at a small pond.

Next morning we rose early and after a hasty breakfast, Billy and I started out to find the horses. An hour failed to locate them in any of the likely places, so we had to come back and begin trailing them step by step. We soon found the track with spoor so fresh as to make us feel certain that they had been there within a couple of hours; but the tracks led away down a long draw, and turned on

a much traveled road, where it was very hard to distinguish our horses' tracks from those of others who had traveled incidentally. After a couple of miles of this they turned off and started across a big barren flat utterly destitute of vegetation. Here we soon perceived that there were tracks of a sixth or extra horse with those of our horses. We trailed them three or four miles across this flat, then over a hill into a narrow gulch, where we found them entirely secluded and prevented from wandering by high walls on two sides and vertical walled gulches on the other sides. The extra horse was not there. Our horses were all tired out and lying down instead of feeding as usual. It was perfectly clear that they had been driven away and hidden. Stealing is out of the question in Patagonia, for no one can dispose of a stolen horse; as when a horse is traded, sold, or given away, the possessor must go before the Justice of the Peace and first prove his ownership by showing the bill of sale, which is then O. K.ed, a stamp affixed, and transferred along with the horse.

The trick, however, is to hide the horses of "greenhorns" in the country, and then sit down and wait for a reward to be offered for finding them. It usually works; the traveler having to offer a higher and higher reward until they think he has reached his limit, finally gets his animals back after paying a third to a half of their value; so we considered ourselves lucky to have been able to track our horses and get them back without further delay.

But it was noon when we got back into camp, and one o'clock when the horses were fed and hitched into the wagon, and there were still twenty-five miles to go over a hilly road. Billy said to me "ride ahead and get a good corral to put the horses in and have plenty of feed ready for them. We will make Comodoro tonight." I pushed ahead on a lope and soon was prepared for them. Then I sat down to wait, expecting them to arrive about eight or

nine; but as I sat watching I saw a race between two wagons to get the lead coming down the long hill toward the town. The winner proved to be our wagon which came in before six. This indicated pretty well the condition our horses were in, though they had been pulling the wagon for some three and a half months.

CHAPTER VII

Comodoro Rivadavia and Town Life

Comodoro Rivadavia stands on a small triangle of land under an overhanging bluff some 800 feet high. Like most of the coast towns it is without a water supply, so that two years before all their water was hauled twelve miles by wagon and sold about the town at 60 cents a barrel. As the town grew and prospered, this became more and more burdensome, until finally to relieve the situation the government undertook to bore for artesian water. In the Andes 300 miles back from the coast there is abundance of good water running in numerous streams, which, however, sink into the ground or dry up as they come out to the open country; accordingly every one of the people feels certain that this water must reach the sea by underground sources, and that to tap this must yield abundant artesian water. I think the successes in Australia in getting artesian water in the barren stretches influence the inhabitants, so many of them having come from that country.

The well was started and went down 1600 feet without results, until suddenly the whole boring apparatus was blown out of the hole by a gas explosion, followed by a flow of oil. Of course this made great excitement and an oil craze followed, during which all the land for over one hundred miles north and south of this point was claimed for oil prospects, the government reserving for itself the center of the area. When we came to the town six or seven wells had been bored and as many more were projected.

The crude oil is unusually heavy and looks not unlike a thin tar. So far it has been found suitable only for fuel, the gasoline and kerosene element being very low. However, as all the coal in the region is brought in bags from

Comodoro Rivadavia Seen from the Bluff Behind the Town

Unloading Wool on the Beach at Comodoro Rivadavia

Wales, even this will be a great boon. While we were there the wells were yielding only twenty-five to thirty barrels of oil a day and half of that was from the government well, which is a pretty poor return for the expense of drilling and maintaining the wells. At first the oil flowed without pumping, but that has changed and the new wells had to pump.

The immediate benefit to the town comes in utilizing the oil from the government wells to run a distilling plant, in which sea water is evaporated and drinking water produced, to be sold for about eight cents a barrel or at the public drinking place for two cents a head for animals. The railroad mentioned previously is also burning this oil, but it runs only one train a week and its demands are not excessive. Some oil has been shipped away, but most of it is consumed on the spot to run the distilling plant, and also the engines used in drilling new wells, which takes about all the production. It seems doubtful that the product will ever have more than a local use.

When we were there all the producing wells were within six or seven miles of Comodoro, a well bored thirty miles to the north having proved dry; but others were being drilled, even 100 miles to the north and south. From the lay of the land it seemed to us that there was but little probability of striking oil more than twenty miles either to the north or the south of the town; for it lies in the lowest part of a shallow fold in the rocks, which also slopes gently upwards toward the interior.

In addition to the activity connected with the wells the town was humming with business. Down on the beach were great and growing piles of wool, in front of which from time to time a great freight wagon would draw up to sell and discharge its two or three tons of wool. There were always buyers there, who as fast as a bale was unloaded had it rolled on to hand scales to be weighed, and the seller and buyer stood by keeping lists of the weights

to be checked up at the settlement. The wool from the big *estancias* was put up in iron-hooped rectangular bales, weighing 450 to 500 pounds each, while that from the smaller places which had no presses was sewed in oval burlap bundles of 150 to 200 pounds each.

Their wool discharged, these wagons were drawn up near some store, where during the next three or four days they were reloaded with a miscellaneous cargo of groceries, liquors, corrugated sheet iron, furniture, tools, etc. Groups of horses and oxen were driven through the streets, going to or coming from the watering place. Before the numerous blacksmith shops stood six or eight wagons, waiting for their repairs, and lines of horses to be re-shod. The stores were all rushed, and we could see why trading is so profitable, for one of these freight wagons will often take from a single store (they are all general stores) a thousand or more dollars worth of goods. Most of the wagons belonged to professional freighters, and, when loaded, were to go to points all the way up to two hundred or more miles inland. This is one of the most profitable lines of business in Patagonia, for their rates run from two to ten cents a pound, and there is always plenty of wool to be hauled out from the interior. Some of these freighters have regular caravans of wagons, one of our acquaintances, for instance, having eighteen wagons and 900 mules; for he always drove nine mules to a wagon and averaged four tons to a load. This was an especially well-appointed outfit and usually went on long trips, a round trip often taking from two to three months; but the owner told us that he could make one hundred per cent. of his investment per year, when he traveled with his wagons. Most of the freighters, however, did a smaller business, running one, two, or four wagons, and about twenty-five horses to a wagon. It is a business in which a man with but little capital can start and work up.

The same is true of the sheep business where many of the men started, and do still, as herders on shares (usu-

ally one half of the increase). After two or three years this will amount to around 1,200 sheep and the man takes his wages and starts in for himself. In this way after ten years a man if at all thrifty will be worth in the neighborhood of $10,000 with which he can start in business almost anywhere. The commercial lines, on the other hand, take a large capital, for credit has to be given to most of the customers until their wool is sold, and the goods, which come mostly from Europe, have to be ordered and paid for three or four months in advance.

We stayed here but a day, having all our horses re-shod, getting fresh supplies, and some more money (for during the month since my previous visit my account had been transferred to the Comodoro bank). At this time the bank was open from 7.00 a. m. to 12.00 m. in order to accommodate the people, most of whom start from town on their journeys during the forenoon.

This time we received our box of saddles which had gone astray over four months before in Rio Janeiro; and mounted on our western type of saddle with its pommel in front and cantel behind, we felt like new men. While in the town I broke the bridge of my glasses, and there being no jeweler or watchmaker in the place, had to take them to a tinsmith who soldered them together, charging me $2 for the job, and assuring me it would have cost five in Buenos Aires.

On the morning of November 11 we got our provisions into the wagon and started off southward for Mazaredo, a road to which place seemed very difficult to find. An old teamster finally started us inland on the Sarmiento trail, which took us all day up a wide canyon, in which there remained but little grass as the road is much used.

As we traveled along this road, from time to time we would meet the freighters, either Boers with series of three to six yokes of oxen, or Spaniards with their horses, all going to or coming from Sarmiento. This is a small but active town about one hundred miles inland, which, when

the government gets to it, will be a railroad center, but is now reached by four or five days of wagon travel. As everything is carried in by this means, hay is $5 a bale, corn (or maize as it is always called in South America) five cents a pound, and everything to correspond. Toward six we found water and camped a few rods from the trail.

Next morning just as we were pulling on to the trail, a Spanish freighter yelling at the top of his lungs, and cracking his long whip over the twelve horses spread out like a fan in front of his wagon, got in just ahead of us. Though it was half-past five in the morning, he was traveling at a slow trot while we felt that at that time of day we could not go faster than a walk. Inside of half an hour some one of the poorly made and loosely adjusted harnesses got out of order and we with our two-horse outfit took the lead. This was too much and we soon heard our rival coming on at a gallop, so that he soon passed us again, and as he forged ahead his wagon grew small in the distance but never got out of sight. At nine we came up with him again and found that he was unhitching, having completed his forenoon's drive of about twelve miles. His horses had to pick up their entire living along the trail and required five or six hours in the middle of the day to feed. We never saw that outfit again, as we went on three more hours before stopping for our hour's nooning. Doubtless, as is the custom, he made eight or nine miles during the afternoon.

At noon we came upon a roadhouse, and it being Sunday, we celebrated by buying our dinner and turning our horses into the man's pasture to get a full stomach. About three we came to the head of that canyon and put on all five horses to pull up the steep pitch on to the pampa. As we came out on top we met a fierce gale of wind howling over the great plain, and accompanied by a drop in the temperature nearly down to freezing. Soon it began to rain on top of all the rest; so keeping all the horses on the wagon

A Boer Freighter Passed on the Road

A Spanish Freighter

we made a dash for a couple of houses just visible in the distance, traveling along at the rate of eight miles an hour for the next two hours. By the time we arrived the rain had changed to sleet, and we were thoroughly wet and chilled. The houses proved to be the railroad station of Colonel Holditch and the *Boliche de la Pampa*. There was little grass, no shelter, and no apparent drinking water for the horses.

However, I found the station agent, Señor Grandiole, who, on reading my letter of introduction, became the soul of hospitality, arranging so that we could get supper at the *boliche*, sending a man two miles with me to show me where to water the horses. We soon got them watered and fed and were very glad to get inside of a building. That evening I felt the paucity of my Spanish keenly, for the tendency was for the conversation to range widely. However, we spent the evening very sociably, drinking coffee in the *boliche*, and went through more *con permisso* and *permitte mes*, with stately bows and other Spanish courtesies than at any other time during the trip.

We slept in the telegraph office, our beds practically covering the floor. In the night a train (engine and one car) arrived and the conductor, coming in to hunt for the sleeping agent and stumbling over our beds, enriched our vocabulary with a series of words we have rather hesitated about using. However, the agent finally woke up, and when he explained over whose august feet the conductor had fallen, that officer became as courteous as the agent had been.

When we rose, though it was midsummer, the ground was frozen hard and the wind still blowing though the rain had ceased. During the evening we had learned of a short cut down to the coast road, about which nothing seemed to be known in Comodoro Rivadavia, except that it was impassable, and judging from its condition when we went over it later, I guess that going south it would have

been impossible. However, by striking it now we were to save thirty miles, so we got our coffee as soon as the *boliche* opened, photographed the Señor Grandiole on duty at the station, also the *boliche*, picked up a guide who was to start us on the right trail, and started.

First we trailed a couple of miles back, then dropped down a steep hillside into a new canyon, and after four or five miles came to the postoffice and former site of the town of Colonel Holditch, where we found the Señora Grandiole and took a photograph of the office, then of the Señora and the *ninos*. From here we had a trail down one of the best grassed canyons we saw anywhere in the country. For twenty miles we passed bunches of horses and sheep grazing along a series of pools of water on which there were numerous duck. We made our noon stop on this water, but at about three we struck the coast road, so called, and entered an extremely dry and barren country, through which we traveled until nearly dark looking for water. Finally we made a false turn and finding ourselves off the trail gave up and camped for the night without water for either our horses or ourselves. To be sure of finding them in the morning we picketed them during the night.

In the morning it did not take long to get under way and we were soon on the trail again, which brought us about nine o'clock to a house and watering place, where we all got refreshed and learned about the road ahead. By ten we came to the telegraph line, which we followed for the next four or five days. During the afternoon we went through a narrow pass between two high mesa-like hills, the appearance of which drew me to explore the larger one. It yielded no fossils, however, though there were Indian graves along the edge of the cliff, but they had been opened and not enough of interest left behind to pay for stopping to dig them out further. About three we came to the house of a Basque, where we got water again. He advised us that there was a German *estancia* only four

A Drink After Twenty-four Hours of Waterless Trailing

Billy and the Team

leagues ahead. Wishing to keep going as long as possible we decided to make on for the German's. All five of the horses were hitched to the wagon, and we went along flying. At two places a side trail led off but we stuck to the telegraph line, until we concluded that we had surely gone fifteen miles, and the *estancia* was to be only twelve: so we picked out a place with fair grass and made another dry camp.

On starting out next morning we met the German on his horse, and he pointed out his tiny hut under the hill not over half a mile ahead. On seeing the place we concluded that the Basque's object had been to pass us along. All through this section there had been less than two inches of rain during the past twelve months, and even if a man had water he hated to see it used. In such a country saving water gets to be a regular mania. About ten this morning we came to a pool by the roadside where we unhitched and spent half an hour letting the horses drink, soak their noses and drink again, an example we were not loath to follow. Continuing we came about two in the afternoon to the sea again at Calleta Olivia, a small German settlement from which wool is shipped and to which provisions for the neighborhood are brought. We got some feed for the horses, then hitched the five in again and started for the water, three leagues away.

The first part of the road was on the hard beach and went finely. Then we struck inland again, and finally came to the desired sheep-shearing sheds and the water. It was a good camp site. We found a couple of young Germans there and as their provisions were short, invited them to supper with us. They turned out to be new arrivals in the country and working for Herr Romberg. We had a very pleasant evening over the camp fire, ranging through comparisons between student life in Germany and America. I was much surprised in this section to see how readily all the Germans spoke English, and asking about it, found

it was simply what they had learned in their public schools at home.

Trailing next morning brought us at once into the sand hills where the going was very slow, but after twenty-two or twenty-three miles we reached the Romberg house about four in the afternoon. They invited us to come up and have some tea, which we were doubly glad to do, as we could go no further, the next water being fifteen miles ahead; and as it was beginning to rain again, the prospect of seeing the inside of a dwelling house was very attractive. It was one of the typical sheet-iron houses as far as the outside went, but inside we were at once attracted to a grand piano filling up half of the living room. Of course we asked Mrs. Romberg to play it, but she hesitated and asked if any of us could. This was just what Turner was itching to do, and he was soon seated and playing the piano with all the gusto of an unexpected pleasure. Mrs. Romberg soon volunteered to sing, and in a few minutes a genuine concert was under way which continued with only momentary interruptions for supper until midnight. Mrs. Romberg was a trained opera singer when, five years before, she had married and come to Patagonia, bringing with her the grand piano (how they got it through the surf and to the house is still a mystery to me), since which time she had never had the opportunity of hearing it played except by herself. That evening will always be a memorable one, the pleasure being especially heightened by its unexpectedness, and by the contrast to the lack of culture in the barren country which we had been traversing. Like so many others we found the Rombergs planning just how soon they would be far enough ahead to sell out and return to the fatherland. We made plans to repeat this evening on our return trip, and were invited to celebrate Christmas there, which, however, we could not plan.

Five o'clock came all too soon, but by this time routine had drilled us so that we were on the road at the usual

A Young Guanaco at the Romberg House

hour, coming about ten to the next water, which was on the edge of the Romberg place. Here we saw a brood of young ostriches which had been hatched by the people and were running about among the hens. They seemed very easy to domesticate, but whether it will pay to tame them is a question. It would seem profitable, from their rapid growth and the fact that they are general feeders, to raise them for meat, though their feathers are of little value. Thence we went upon the pampa again and had fine roads the rest of the day.

We were to find water just beyond the first fence on the left of the road. About half-past six we found the fence all right and began looking for the water. After perhaps two miles we spied a lake of good size (ten acres or so) on the left. Thinking this undoubtedly the place, and also finding a good slough of grass, we stopped and made camp. On going down to the lake we found all along the shore a rime of white, which proved to be salt crystals four or five inches deep, and the water was bitterer than that of the ocean. We had stopped on one of the numerous *salinas* scattered all through this section of northern Santa Cruz. The country is nearly level, and the wind has blown out shallow depressions in the plain, in which all the surface water of the adjacent country accumulates. There being no outlet the water gradually evaporates, leaving a more or less concentrated solution of salts, until it is saturated and begins to deposit beds of the contained salt. Some of these are of nearly pure sodium chloride, and from such the salt is gathered by the wagon load and given to the sheep. In others there are various salts, in which cases the deposits are as yet not used for anything. These *salinas* are quite destitute of life, for they are too strong for aquatic animals, and as no plants can grow in them, there is nothing to attract the water fowl. We were in for another dry night, but as the grass was good

and we had a couple of ostrich eggs for ourselves, we did not mind so much.

After a couple of hours' traveling next day we found the place where the sheep watered and got our supply. It was easy going and at about half-past three we came to the Kelly place, where two Anglo-Argentine brothers had a large mob of sheep. It began to rain again (we seemed to bring the rain wherever we went), so we made a camp. I went over to the house to ask permission to camp and see how the land lay. Talking was uphill work, but finally Kelly said, "Why don't you bring the others over and have a cup of tea or something?" I did; and we were soon congregated around his stove. The "tea" proved to be Scotch, and "something" developed into a good supper, so that it was about nine before we got back to the wagon, but we were richer by a good set of Indian implements which the Kellys had given us.

Half a day's run brought us to the town of Mazaredo, which I am confident is the most forlorn place on the map. It consists of six buildings in a row along the beach, behind which there is a great basin, three or four miles across, which appears like a dried up lake-bottom. While we were there (and the people said at all times) it was simply a plain of parched clay from which continuously rose clouds of yellow dust. After lunch Billy and I began to look for a camping place and finally decided to stop near the postoffice, which is about four miles inland on the telegraph line, and near the water supply. For years, ever since the port has been used, the people have agitated moving the postoffice down to the beach, and three years before, the government went so far as to land the wire for extending the telgraph line, but had not then gotten to sending the poles.

We found this part of the country mostly settled by Scotch and colonial English who had come here by way of Australia. The same is true of all the territory of Santa Cruz.

Mazaredo, the Most Forlorn Town on the Coast

According to Ameghino's notes we were in the midst of a highly fossiliferous area, so next morning we went out with high hopes. Night, however, brought us together again without any fossil bones, though we had found considerable quantities of marine shells in the rocks. In one spot in particular the rocks were simply peppered with petrified sea urchin shells, mostly of the type commonly known as "sea dollars." Finding the upper beds to be purely marine, we were further disappointed in finding that the lower beds showed unmistakable signs of having been greatly altered by the action of heat, the clays being baked until almost like porcelain, and the heat having brought out a series of yellow, pink, and brown colors which were highly picturesque, but showed that we could expect little or nothing in the fossil line.

The next day Shumway and Turner went to the shore to hunt up some shell heaps reported to us, while Stein and I made a careful section of the series of rocks exposed here. The boys found the reported shell heaps, but these were very thin and of dubious origin, yielding only a few seal bones and one arrow point. We had hoped they would show something about the early Indians.

November 22 being my birthday, was declared a holiday, which the boys put in developing our accumulation of photographic films, while Billy and I rode up the beach in search of Ameghino's Notostylopus beds, which he said extended from the town nine miles along the beach to Point Casamajor. We went the whole distance examining the cliff all the way, but not finding a trace of them. However, coming back we blundered into a small pocket in one of the canyons, where we found a few fragmentary bones. This I believe is Karl Ameghino's locality, but in a couple of hours we went over all the exposures of that horizon, and had picked up about all the bones which could occur there; so we had to ride back once more disappointed.

CHAPTER VIII

On to the Rio Deseado

On the morning of the twenty-third, camp was again struck, the horses hitched in and driven to Mazaredo, where a two weeks' supply of provisions was loaded in, and ten o'clock found us on the road for the *estancia* Madrugada (rising sun, so called from their brand ⅄). The distance was only six leagues and the road fair, so at about three we came to the house, a commodious sheet-iron structure with wide porches in Australian style. Inside it was fitted with paper on the walls, rugs on the floors, and bookcases of books all about, clearly the home of culture. The full owners were out among the sheep, but we were invited in and soon seated around Miss Whitaker's wicker tea-table where we were shortly joined by the men, O'Mahoney, Grant, and Bailey, from Ireland, Wales, and Scotland respectively, though all by way of the various English colonies, mostly Australia, while Miss Whitaker had lived a considerable part of her life in the Falkland Islands. It was a jolly place and we had a royal evening.

They were in the midst of shearing their 30,000 sheep, and that summer, on account of the Italian-Turkish War, everyone was very short of help and the shearing consequently much prolonged. As the shearing season requires many extra men, gangs are usually formed going from ranch to ranch, ten to twelve of them in a body. These gangs are mostly Italians who have come over expressly for the shearing season. Their fares to Buenos Aires amount to only about $15 each, and they arrive in time to begin the shearing about October first, starting in the north and working southward, ending the season in February in the neighborhood of the Straits of Magellan, after which be-

cause of the high cost of living in Argentine they return to Italy until the next season.

Experienced shearers shear from eighty to one hundred and twenty sheep a day, according to their size and the wrinkled character of the skin of the various breeds; and receive from ten to twenty cents of our money per head for the shearing. The price is agreed upon by a padron beforehand, and again regulated largely by the wrinkled skin. Thus the shearers make from $7 to $10 a day. The same sort of migration takes place in connection with the harvesting of the wheat in northern Argentine. These movements explain the curiously large immigration and emigration figures for Argentine Republic, of which usually only the former are published. However, it is true that a large number of Italians settle in Argentine, and become laborers, especially in the building of railroads, streets, bridges, and houses.

To return to the sheep: they were originally mostly Merinos, brought from Australia, and the pure Merino of course yields the finest fleeces of wool, but the fiber is neither long nor the fleece heavy, so that on the progressive ranches the original stock has been crossed with various larger longer-haired varieties, like Lincolns and Shropshires, which yield a longer haired and heavier fleece, though it brings less per pound. The problem confronting them all is to get the grade which will net the most money per head, and it has been found that the fairly fine medium-weight fleece brings more money than either the finer light-weight high-priced fleece, or the coarse heavy-weight low-priced fleece. The nearer a pure Merino, the cheaper it is to get the sheep sheared. The wool is hauled to the coast and sold either to the local buyers, or by the larger ranchmen who can afford to wait for their money, in Buenos Aires or Europe, where it brings considerably more, as the local men have to make a living and a good one, on the differences in prices between the local and the central markets.

One of the sheepman's greatest problems is to dispose of his meat, and at present that is practically lost, except what he can save by selling locally or by eating. The ewes are much more valuable as they yield both wool and young, the former paying the expenses and the latter being profit roughly. The wethers can not be made to yield much more than enough to pay for their keep, and then there is no sale for them in the end, as the older they get the less wool they yield. At present the wethers bring less than $2 a head, and are chiefly used to feed the owners and their help.

With the present transportation facilities it is not possible to ship them anywhere, for the arrivals of the boats are indefinite and when a man drives a herd of sheep into a town he is pretty sure not to find his boat. Then as there is no feed close to the town, they must be driven out again, and meantime the boat may come and go. The only solution seems to be in the way of establishing refrigeration plants in the coast towns; which has not yet been done, though at two points there are canning and rendering plants which take care of the wethers within a hundred miles of the plant.

Coming back to our hosts, it was planned next day while Shumway and Turner remained to help among the sheep, that Mr. O'Mahoney should ride out with Billy and me to look over the country. Right after a five o'clock breakfast (in this section the Englishmen get up about this hour, prepare themselves coffee, buns or sweetened bread, and then go out to work, coming in for breakfast about eight; if they do not expect to get in by eight they add cold meat to their coffee and make the best of it) we started off toward the coast to look over the exposures there and find a camp where Ameghino had lived and worked some weeks, and presumably had found fossils. The seashore was soon reached and we rode through some of the roughest country imaginable, where the sea had undermined the cliffs and

caused one landslide after another, which had piled up on each other below the great cliff in the wildest confusion. Ameghino's camp site was found, and the exposures looked so good, we determined to give the locality a good try out anyway.

Then we circled back toward the house, bringing up at a Spanish *estancia* some three miles from La Madrugada, the foreman of which had seen some gigantic bones and offered to show us the place. First, we had lunch; and then all four set out at a pace set by his fresh horse. After six or seven miles we came to a large *salina*, the margin of which was made of that curious mud which dries on the top remaining like jelly below, and which mires so many horses and sheep. Our leader had tested out a path over this and was soon pointing triumphantly at two large concretions which were roughly the shape of vertebræ, and by imagination had been converted into a buried whale. He was much chagrined when we told him as tactfully as we could that they were not and never had been bone. But he said he knew where there was one bone he was sure of, which he had seen three years before. So we started on again, and after two miles he stopped in the midst of a great nearly level plain, and said that he had dropped the bone about there. Inside of twenty feet we found it in the grass. Then he led us to the place where he had found it. It was the Patagonian layer, and marine, and therefore of minor interest to us, and of still less when we could find no further fragments. However, from us who, when we leave a specimen for even a day or two, build near by a monument a couple of feet high to mark the place, this exhibition of locality memory drew forth great admiration; for in the meantime this rider had been scouring miles of country in every direction. We found that these men who are constantly riding often do such feats and take great pride in the ability to do them, often having contests and betting on their ability to ex-

actly locate places and objects. Lastly we rode to a small exposure, also Patagonian, where we found a few fragments of dolphin ribs. These men who ride after sheep are very keen about seeing petrified objects, so that in a new country they may be very helpful in getting one started in finding specimens if there are any about. When we got in it was about six and we were ready for supper.

In the morning we brought our wagon across country to the head of a long canyon, down which we went across bushes and gullies until we came to the water hole located the day before. A camp site was finally picked in the very bottom of the narrow gully where for once we were fully protected against the wind. By noon we were fully located and spent the rest of the day exploring the nearer breaks. No bones turned up, though there were hosts of marine shells in the best state of preservation of any we had yet encountered. Of these we made a goodly collection. But we were hunting bones. Next day the story was the same except that we got a considerable distance from camp. While the tide was out, going along the beach was easy and we rather lost track of the distance. When we came to return the beach was covered, which forced us to climb over the breaks and boulders. Billy and I got in a little after six, but the boys were further out and starting back later had worse troubles, finally coming in with their tongues hanging out just after dark. We had really become worried about them. It was a country in which one is easily lost, for the mouths of the multitude of canyons all look much alike. We had all been equally unsuccessful, so after spending the first half of the next day bringing in some finds of shells which we had made, we broke up the camp, did some fancy driving in turning around and getting out of the gully, and returned to the *estancia*.

There was still some country which we had not seen between us and the Deseado River. So we arranged that the boys should stay at the ranch and help with the sheep,

while Billy and I took two of the saddle horses and explored as far as the river or until we found something. Saddling Blackie and Colorado we started to "ride the chuck line" as they say in the West, when one starts out expecting to live on his neighbors as he travels. Our first day brought us to nothing new and we stopped at a small *estancia*, where we did not meet a very cordial reception from the owner.

Next morning about ten we rode up to Tom Hall's, who averaged up by the heartiness of his welcome, and soon proved to us that he knew more of the natural history, geology, and Indian lore of the country than any one else we had met. When we told him what we wanted to see, he replied, "that is just the sort of a trip I have wanted to take." We said, "come on." He replied, "all right." Then he caught up two horses, one to ride and the other to carry the pack, which he furnished, consisting of blankets, grub for three days, and a few cooking utensils. After lunch we rode five or six leagues across country, until we came to the mile-wide valley of the Deseado River, the stream itself being about three feet wide and a foot deep, and entirely dry in the summer time. Here we turned up the valley until we came to the first of the steep white *barrancas* which make the walls of the valley here.

There we camped for the night. It was one of those gorgeous nights made perfect by the contrast with what one usually gets. Soon a roast of lamb was sizzling before our camp fire, after eating which we sat until well into the night while Billy matched tales of the sea and the cow camp against those of Hall's of the mining and sheep camps all over Australia. He had put in twenty years of his life roaming all over that continent. Cheap land (he was squatting) brought him to Patagonia, but he had already made his plans and could see that in two years he would return to Australia with money enough to make

a start there, and educate the series of little Halls whose physiques Patagonia had already made as hard as nails.

Next day we worked up and down the *barrancas* looking for the ever-elusive bones, but found that like the clays by Mazaredo, these were also baked. As we gradually worked down the stream we came into lower and lower layers which were more and more baked, until about noon we landed on the top of the lava sheet which had done the baking.

Just before lunch we spied a goose acting suspiciously, and soon found her nest with five eggs in it. They were nearly fresh and we gathered them all. For lunch we had bread and tea in which while hot we each stirred a goose egg, which made an unexpectedly good combination. We saved the remaining eggs and the egg shells, which were tied up in a handkerchief and I carried them for the next three days slung around my neck, getting four of them safely back home. During the afternoon we came down to the "Eye of Waters," a wide lagoon-like expansion of the river, where the water was shallow and full of reedy islands, and where hundreds of ducks, geese, and flamingoes were paddling about. They were wise, however, and kept well out from the shores or over the lagoon, where they were safe, as we could not come out into the water on account of the deep mud about the margin.

Here we saw the finest contact possible between two formations. The lava had welled up from some throat or seam, and coming to the light clay formation had lifted it on its molten surface as if it were floating: then the lava had pushed its way for miles under the clay layer, baking the lower layers completely and the upper ones gradually less, but affecting them for fully 250 feet up. The basal layers of the clay, where they came in direct contact with the lava, were broken, crumpled, and twisted in every shape. It was a geological phenomenon worth coming all the way to see, but of course the sort of thing we could only

see. We spent the entire afternoon exploring the contact, and studying the effects of the combination of hot lava and gigantic force. At dusk we sat down to another roast and another evening of stories.

The morning brought us to the first of December, and we saddled up to begin our return journey. Billy was riding one of Hall's horses which had tried the previous day to buck some; but this morning as he mounted, the horse went at it with such earnestness, that after tearing one boot to pieces, he pitched Billy off; then proceeded to buck off the saddle, and run away. However, he was easily caught again; for he had worked so hard that he was tired out. After this we put the pack on his back, and he tried to buck this off, but it was wrapped around his belly and as he had used up his best energy, he gave it up and went along like a lamb the rest of the day. We struck off across the pampa, and a little after noon reached Hall's house, where we had lunch and then went out to see some localities he had to show us, finally spending the night at his house.

While here he gave me the skins of three Patagonian hares which we had seen several times but could not get close enough to shoot. These hares, so called, are really cavies, closely related to the Guinea pig, but in adapting themselves to the open and barren prairie they have developed long legs (especially the hind ones), with the general appearance of a jack rabbit, though the ears are not so long. In every way they take the place of our prairie jack rabbit, and for a long time I thought they were really members of the rabbit family. In one respect they are quite peculiar, traveling in groups of from two to ten (sometimes more) and following one behind the other, so that as they leap they give the appearance of being parts of one long animal.

I further arranged for some skulls and skins to be shipped to me the next winter. The children had collected birds'

eggs of several sorts, many of which they gave me, but I had to buy Paddy's (three years old), promising him a can of pears for them.

In the morning we had some difficulty finding our horses, which had strayed some eight miles from the house, but about noon we mounted and rode straight across country for the *estancia*. About two miles from our destination Billy started to teach Blackie to open and shut gates without the rider dismounting. The opening went all right, but when the gate was coming shut, the horse bolted and jammed Billy's foot against the post, giving it a bad wrench which took over two weeks to cure. We got in soon after, in time for supper.

While we were away the boys had spent half of each day in the saddle on a fresh horse every morning, to bring in sheep for the shearers, and in the afternoon had worked in the pens and sheds, until they had learned to muster, drive, draft, dip, mark, and cut sheep, and had become so enthusiastic that they were willing to continue the job indefinitely. Our team had had a week's rest in good pasturage.

Our plan had been to start next morning on the long drive of over 230 miles to Comodoro Rivadavia, but we found a big muster of sheep planned for and the extra men needed to hunt out the sheep; so we put the start over until Monday morning and all got out about four in the morning to gather the 3,000 sheep wanted. We had good luck and before nine had the mob of sheep in the corral, and before noon they had all been through the drafting runways, and three or four hundred wethers were picked out to be sold to the railroad camp. The remainder of the day we spent simply loafing around the ranch or reading at the house. Next morning it was with many regrets that we said good-by to our very generous friends, making plans to hear from them, and if possible to see them when they made one of their pilgrimages to England.

First, we pulled into Mazaredo to ship our accumulated

A Typical Estancia Built of Sheet Iron

The Boliche at Mazaredo

collections and extra baggage, and to get supplies for the journey. Here we found the Hall family, Mrs. Hall and the children having come in for three or four days to enjoy the sea beach and the people of the town. We found the custom of bringing the women and children in to town for a week or more each year for an outing to be quite general. It certainly is appreciated by those who are from five to twenty miles from a neighbor. I paid Paddy his can of pears. Here we sold the shotgun, our stove and two of the saddle horses, Colorado and Paddy, losing a little on the one but making it up on the other. I hated to leave Colorado, the horse which had carried me over 1500 miles, and while not smooth gaited, was strong and willing, and especially good when working on the cinch helping to pull the wagon. Shumway regretted as much to part with Paddy, his practical teacher and companion. It took until ten the next morning to get all the papers for the horse sales made out and recorded. Then while Billy and Turner packed the collections, greased and loaded the wagon, etc., Shumway and I borrowed a couple of horses and rode eight or nine miles up the beach to make a section across the Notostylopus beds, and if possible to find an extension of their exposure. The first job we did, but the latter proved impossible, and we only found a few more teeth and then abandoned the search for more bones in this bed.

Wednesday morning we left Mazaredo with a gale of wind and dust in our faces, with but one saddle horse and three men on the wagon or walking to vary the monotony of the journey. Thus lightly loaded we passed Kelly's about noon, and kept on as far as Bain's. We hoped to camp at this house, but found the yard full of the camps of shearers and freighters, and the grass and feed all cleaned up by them, so we went on around the corner of the fence and camped on a spring which he had there. The day had netted fully forty miles. On the next day the wind again continued from the north, the first strong north wind we

had had during our trip, but we had pampa going and knew that Romberg's was at the end of the day's march; so we pushed ahead as fast as possible, reaching the *estancia* about four in the afternoon. Mr. Romberg was away buying rams, but our welcome was no less cordial. Before supper Turner photographed the Romberg twins, and also the young guanaco illustrated opposite page 102. Then after an early supper a second *sängerfest* began, with Mrs. Romberg and Turner as leading actors.

In the morning we stopped for coffee at the house, not getting away until eight, after which we covered the eight leagues of sand and hills to Calleta Olivia, reaching the little town in time for supper. Here we had to buy water for the horses at ten cents a drink, but they were thirsty enough so they got their money's worth. It is a town with but one well in it and the water from that is only used for horses, the people hauling their drinking water from four miles out.

It was Saturday morning as we pulled up the long hill from Calleta, passing near the top one of the Boer freighters who had started about an hour earlier. Soon after this we came to a point where the road forked into three branches, and here for some reason we took the wrong fork, and in an hour or so brought up in a man's dooryard at the end of the road. He told us we could strike the other trail by going half a league across country to the south. Either his unit of measure differed from ours or he had never tried the crossing; for we went fully five miles across the worst kinds of brush and up and down all sorts of bad hills before we found our trail again. At noon we came to that German place we had missed on the down journey. This time our friend was vastly less cordial, and had developed a rheumatism which prevented his leaving the house. However, he pointed to the southeast to a place where he said we would find water for our horses within half a mile. We tried and failed to find the place. Coming back he pointed to

the east and was astonished we could not find the spot. The new direction yielded the same result, and it dawned on us he did not want to give us water; so we swallowed what of our wrath we did not express, and went back to our wagon, shaking the dust of his hospitality from our feet as we went on without water.

About six we got to the house of the Basque and found a watering trough full of the most refreshing water; a welcome find, for on this trip we had planned to get drinks at two points, missing the first by our detour, and the second by a trick. Here we got out our last two ostrich eggs, and I sat down to drill holes in the ends of the shells, through which we blew the contents out. The first one needed no blowing, for of a sudden it blew first, sending a jet square into my face, and showing how highly charged it was. We saved the shell, however, for the museum. The second egg proved all right, and with it, to which he added macaroni, and a pound of raisins, Billy made a gallon of what we called "powerful feed." It certainly was the best meal we had on the trip.

The first half of the next day was over good roads, but all the water holes had dried up, and in the afternoon, we struck that part of the road which made people say it was impassable, for there were steep hills where the rains had torn out eight-to ten-foot-deep gulches in the trail, and other places where on the steep slopes the sand had drifted in, in banks many feet deep. Our horses were trained to it, however, and we got through, finally coming down a steep hillside into a narrow valley where there was good grass, though no water. Here we stopped. For ourselves we had some water in the canteen, but it was tough on the horses.

But next morning about an hour after starting we came to a good spring, after which we all felt better. The road improved and we coasted along down a long canyon toward the ocean, reaching the town of Comodoro Rivadavia

about noon, having covered over 200 miles from Mazaredo in four and a half days, and this with the two wagon horses which it had been prophesied would not be able to last more than ten days from the beginning of the trip. The balance of the day we gave to rest and the reading of our accumulated mail.

Among the letters was one from Mr. Potts who was to buy our wagon, indicating that he would not be in town. So next morning at six I mounted Blackie and started the forty-mile ride along the shore and beach to Port Visser. Reaching there about four I found him in bed with inflammation of the bowels.

In the morning feeling better and desiring to see a doctor, he decided to come into Comodoro, so consulting the tide we hitched one of his horses and mine into a sulky and started, but we were too early for the tide and had to wait an hour for it to go out; after which we pushed along the beach until five, when both Mr. Potts and the horses were tired and we had to take an hour's rest. Hitching in at six we traveled the final twenty miles up hill and down as if the "Old Boy" were after us, reaching the hospital at the railroad camp about nine. Here I left Mr. Potts and went on into town.

Next morning having had his first food in five days and feeling better, Mr. Potts came over to the town and bought our wagon and two horses. During that day we also sold our three saddles, all of our sales netting us as much as we had originally paid for the equipment. It took all day to arrange these matters and get the transfers registered. While making bills of sale, as Billy was to stay another month, I transferred Blackie to him, and made out various legal papers authorizing him to act for Amherst College. Next morning we started Mr. Potts off on his road with our fine team and American wagon (wagons from the United States are in great demand in Patagonia, being so much lighter and stronger than the high-wheeled Spanish type).

Loading the Lighters with Wool at Comodoro Rivadavia. Last of Patagonia

Then we packed up all our personal effects and were ready for a boat to come in. On Sunday morning (two days later) the *Camerones* put in and began to load the hundred or more tons of wool on the beach. It was not until four o'clock that we were allowed to walk the plank into the lighter, and thence on to a small tug which plowed through waves out to the ship, during which voyage all the passengers were thoroughly soaked by the flying water.

We had covered over 1,000 miles with the wagon and half as much more on the saddle horses, had prospected 500 miles of bluffs and with a good collection and data for geological work, we were fully ready to turn our faces toward home.

The boat stopped at three or four more ports for more wool, and brought us on Christmas Eve into Buenos Aires, too late to go to the banks, so we could not take advantage of sailing on the *Cap Finisterre* next day on its maiden voyage. This was the biggest boat then in the South American trade, displacing about 17,000 tons and built with especial reference to going up the La Plata River, which permits only about seventy feet of draught. Thus we had to wait four more days.

Christmas in Argentine is not the holiday it is in the United States; and next morning we found only the larger stores and offices and the banks closed. There was not as much notice taken of it as of a regular Sunday. Only one feature seemed to be peculiarly striking, and that was the *pan dulce* (a sweetened bread with raisins in it) with which every bakery window was piled high, and which was sold by the kilo in loaves of from two to twelve pounds in weight. The eating of this and the use of some simple candies seemed to be the only celebration among the Argentines. The presence of great numbers of English and Germans in the city was, however, indicated by signs in the store windows, calling attention in these two languages for presents for the *Natividad*. In the matter of candies

it was noticeable that there were neither our great quantities, variety, nor the predominance of chocolates as here. The lack of a Christmas celebration is largely explained by the big festival celebrated on New Year's Day.

We bought our *pan dulce* and candies and made an attempt at a Christmas celebration, then went out on the Avenida at this midsummer season, and especially on this day, to find the cafés crowded, but neither on this day nor on any of the others, either during the summer or winter, did we see indications of the gay street life for which many of the tropical cities are celebrated. By eleven the streets looked deserted, and what little stir there was earlier was over. We found the cafés serving *helado*, which equals "frozen," and it is about as near to ice cream as the article comes, for the great predominance of water and the shortage of cream in the original mixture make it pretty thin food. But as we had had nothing of the sort for six months we enjoyed it just the same.

Sunday followed Christmas and it was not until Monday that we were able to get our passage moneys out of the Bank of London, cash our drafts on a wool merchant, arrange for the transportation of our freight yet to come, and finally book a passage in the *Highland Glen* for London, as there was no boat for New York for nearly two weeks, and the cost of the trip via London, though 4,000 miles longer, is the same as if one goes direct. And in time it takes but three days longer, not to mention the more frequent sailings *via* Europe; for there are three English lines, two German, a French and an Italian line, three of them sailing weekly, and the others fortnightly or monthly.

Our business done, we still had a couple of days in which to write a letter of thanks to the various officials who had been so kind to us, to visit our friends and to do a little shopping. In general the stores are very uninteresting considering that it is a foreign country, for the same articles

will be found in any New York or American store, their goods being nearly all made in Europe or the United States. The element of being quaint, appropriate, or tasty is entirely lacking. Even souvenir spoons were wanting. The jewelry stores were of all most disappointing, for Argentine has no native gold, silver, or precious stones. There were no pretty little objects. The silver was heavy and overwrought, the gems were showy and merely big (prices also). After a thorough search we found as characteristic some handsome rugs made of the baby guanaco skins, and sold for 100 pesos each, the duplicates of what we had seen everywhere on the Patagonian coast for 30 pesos. We only bought a few *maté* cups and the *bombilloes* which were really native. But Buenos Aires is a good place to buy the fine hand-made lace which the Paraguay Indians make, and there are attractive baskets made from the shell of the armadillo with the tail caught in the mouth for a handle. These were also made in Paraguay.

On the twenty-ninth we left Buenos Aires by a special train for La Plata, where some of the boats dock to avoid the heavy harbor charges of the capital city. Though we went on board at once it was nearly a full day before the boat pulled away from the dock; for Argentine was then in the sway of a great dockmen's strike. These *Highland* boats are engaged in the business of transporting refrigerated beef and mutton to England, and we were not entirely loaded; so all the afternoon and evening we sat and watched the carcasses of mutton and quarters of beef come sliding along the overhead trolleys out of the great refrigerator houses, move across the dock and down into the hold, each one sewed up in a nicely fitted cheese-cloth jacket, and protected by awnings all the way from the buildings until in the hold. The people were not so carefully protected against the sun (presumably because they were still alive). Fortunately being lightly loaded on the trip out from England these boats carry their coal for both

trips (which must be a big saving); so we were not held up for that, which would have meant several days. Some boats at the time were held weeks before they could get their coal on board.

These boats sail direct to London, except sometimes to put in at the Cape Verde Islands, if they need any extra coal, making the run in twenty-one days. If it takes more than twenty-two days, their contracts require them to pay a daily forfeit for overtime. In this manner ten thousand tons of meat come weekly to John Bull.

In due time we reached London, and from there crossed to New York, arriving the day before College opened for its second semester.

CHAPTER IX

Billy's Experiences

We left Billy standing on the beach at Comodoro Rivadavia. As he could not begin collecting in North America until May, he was willing to stay an extra month in Patagonia and look over some of the formations which as a party we had not had time to explore, thereby finding out just where any succeeding party should start in work without the considerable loss of time to which we had been subjected through lack of knowledge of where to begin. Next morning he mounted Blackie with about thirty pounds of luggage, *i. e.*, a little clothing, a blanket, some small tools, compass, map, and about ten pounds of food for man and beast; and was soon wending his way back upon the pampa, and across to Ventner's ranch which he reached in two days. Here he made his headquarters for some days while he rode north and west, prospecting the bluffs down the Chico River, where we had not been able to explore while camping in this section. Unfortunately they proved as barren as most of what we had seen, and it appeared that the pocket we had worked was the only one in that neighborhood.

After the holidays, on the second of January, Billy left this hospitable homestead and started to work up towards Lake Musters. From his diary we get such entries as this of January 2, "Camped out near the Rio Chico, grass pretty poor, strong west wind, night cold and stormy;" which means that with the horse tied to the longest rope he had to get all the grass possible, Billy had made a small fire, burrowed into a thorn bush, and wrapping his blanket around him, got what sleep he could, rising two or three times to warm himself, and to move the horse where it

could pick up a little more feed. Such prospecting is lonesome work, especially where even the few people one meets cannot speak one's language.

On the fourth of this month, a few miles south of the beginning of the river, and a little above the basal layer of lava he found the first traces of dinosaur bones, over the presence of which there has been in the past so much discussion. In the northern hemisphere this group of gigantic reptiles died out by the end of the Cretaceous epoch, but in South America Ameghino found some of their bones commingled with the bones of mammals of the Eocene types. This could, if true, be interpreted in two ways; either that in South America the dinosaurs lived to a later period than elsewhere, or that there the mammals arose earlier. The latter was the interpretation Ameghino put on his finds; while the former is the one more recently advocated. But the fact of the contemporaneous occurrence of these two types of animals was doubted, especially by Hatcher. Since then Roth has confirmed that the bones of the two groups do occur in the same strata, and it was a point on which we were especially anxious to get some first-hand data.

Next day Billy continued his work along this stratum, coming to the south of Lake Colhue-Huapi, and in beds either of the same age or older than those in which he had found dinosaur bones, he found a small collection of bones of the Notostylopus types. In getting to these bluffs he started across the bottom of a dry lake. The surface proved treacherous and as he expresses it he "got stuck several times and almost lost Blackie." He worked here all day and that night "camped near lake shore, the country barren, no feed for horse, some ostriches and guanaco about, ate some berries to satisfy hunger."

From here he proceeded toward the Pueblo Sarmiento which is the small town in the midst of the mixed colony of the same name. When the Boers came to Patagonia

they more than filled the land assigned to them, so a second colony was started on the level stretch between lakes Colhue-Huapi and Musters, and this was opened to settlement without any national restrictions, being now occupied by Boers, Welch, Spanish, Russians, etc. In this case the land being considered better, each settler only obtained a quarter of a league either near the lakes or along the River Senguerr leading into Lake Musters. It is expected that they will be able to irrigate this land.

On the way to the town a night was spent with Mr. Castro, "a good fellow, but can't speak English," with whom next morning Billy rode over much of the country south of the lake (Colhue-Huapi). Here they saw enormous flocks of waterfowl, ducks, geese, and flamingoes, which as they are not much hunted showed little fear. Passing on from here to Sarmiento he met a Mr. Jones (Welch like nearly everyone of that name in South America), who showed him his considerable collection of Indian relics and fossil bones. About the localities where they were found, he was, however, unwilling to give any information. Next day Stein visited the public school, where, as he could not make an address to the pupils in Spanish, he stood as the subject of a talk by the master. It was noticeable that in all these rural schools most if not all the teachers were men.

In the afternoon he went on, skirting along the south of Lake Musters to the Herzog ranch occupied by a Russian German, where Billy's knowledge of the Russian language won him a hearty welcome. Here, again, there was a collection of fossil bones, and again the owner was unwilling to disclose the localities where they were found. It was only in this section that we found this feeling about telling us all about fossils; and it was probably due to the fact that two or three years before there had been found near Sarmiento the remains of a very large dinosaur, of which the government had at once taken possession. The speci-

men has not yet been excavated. Its value is largely speculative, and will depend mostly on the skill with which it is collected, as is so largely the case with all these ancient remains. However, this has led the people to try and capitalize the finds which they may make.

From here Stein went to the southeast into the San Bernado hills, a very broken piece of country, made up partly of volcanic lavas and partly of the Patagonian sandstones with their marine shells, with here and there exposures of the reddish beds in which dinosaur bones are found. On the tenth he reached a second member of the Herzog family, and all the succeeding day was confined to the house by the "terrific winds" which made riding impossible. Though this was in the middle of January and the hottest time of the year, all through the diary run such entries as "night cold and windy," or "night freezing." In the valleys among these hills the grass was better than near Sarmiento.

On the night of the fourteenth Billy had worked up to the northwest corner of Lake Musters and camped near the shore at the foot of a headland known as Cabo Pastel, for variety the weather being warm and the lake covered with thousands of ducks and geese. After picketing out his horse he rolled into his blanket, only to be awakened after about an hour by the bellowing of an approaching wild bull which seemed to threaten his horse especially. He got up and by waving his coat and running and shouting at the animal drove it off. A couple of hours later it came back and this time was much harder to turn. The third time the bull approached Billy was tempted to shoot at it, but as it was dark and knowing the irresponsibility of a wounded bull, he got ready to drive him out again or vacate the camp hastily, when from the opposite direction he heard a faint answering bellow, and realized that it was not him or his horse the bull was after, but to get at an adversary.

So he sat down and the bull passed quietly by and disappeared in the direction of the challenger.

Next day Stein continued around to the north of the lake and fell in with an Indian who gave him shelter in his hut, where they were weather-bound for the ensuing day by wind. When they could get out, Billy found an ancient Indian burial corral, where some twenty Indians had been buried in a circle, all with their heads toward the center. Unfortunately the place had been desecrated and all the skulls taken away, together with such implements as had been buried with the bodies. Only the skeletal portions remained and they were badly scattered.

The next camp was by the lake, and under January 18 the diary reads "breakfasted four a.m., meal and water;" after which he worked his way down, reaching another Russian ranch about seven in the evening, where "after hearty supper felt better." On the 22d while prospecting the low hills to the east of the lake, Billy happened on to the government's dinosaur. But a small amount of it was exposed, and of course our interest in it lay only in that it showed us in which of the beds to expect good dinosaur bones.

Having completed the circuit of the lake, and having found three good localities for fossil bones, to which we or another museum could come in case it proves desirable to continue the work in Patagonia, Stein started back towards Ventner's reaching that ranch on the 27th. From here he rode over to Comodoro Rivadavia and back in six days for the purpose of picking up any mail which might have been forwarded to him there. At Ventner's he sold Blackie, a most faithful horse which had shown good endurance both when well fed and when half starved.

Thence he joined a party of Boers who had to go to Rawson, the capital of the territory, to take the oath of allegiance to Argentine Republic; and they on relays of horses rode down the Chico valley considerably over 300

miles in four days to Gaimen, whence they could take a train to Trelew and Puerto Madryn. Fortunately a steamer came in the next day, and Stein left on it for Buenos Aires, and thence via London to New York, arriving home the latter part of March.

I do not want to close this narrative without a word of appreciation of Stein, whose expert knowledge in handling horses and of plains' life was a great factor in our success; and whose previous training in collecting made it possible for him to add materially to what the Amherst Expedition had accomplished.

CHAPTER X

Results of Expedition

After the preceding running narrative I should like to sum up the general results of the expedition as they appear after a preliminary survey of the material, now that it is all together. It is to be understood, however, that these are not final, such conclusions being only possible after a more complete study of the details of the collection. Such final results together with the bases for arriving at them are to be published later as the second volume of the report of this expedition.

First, as to the age of the beds in which most of our work was done. The difficulties in the way of determining this easily are mostly in the fact that all the numerous remains of mammals, birds, fishes, and shells belong to species and genera known from no other part of the world. The stratum best suited for comparisons is the one which carried the large oysters and to which I have always referred as Patagonian. From it we collected some 3,000 shells belonging to over fifty species. By Ameghino this bed was first called Patagonian, and later divided into "Supra-Patagonian, Juliene and Leonense" and assigned to the first part of the Eocene (3,000,000 years ago). Ortmann after a very careful study of the shells collected from it by the Princeton Expedition concluded that there was but one layer, the Patagonian, and that the other names represented only local phases of the bed; and that its age was Lower Miocene, a whole geological age later. Von Ihering and Scharff have adopted Ameghino's conclusion as to the age, but in spite of the difficulties of the shell evidence Ortmann's determination seems to me correct. Then in addition to that evidence there have been found in it

numerous shark's teeth, which though not conclusive, are also of Miocene character; and finally and to my mind conclusively, the cetacean remains of which there are a good many, and which do occur in both the northern and southern hemisphere, have been assigned all of them to Miocene or later types. This study of the age was of great importance to the Princeton Expedition, as their chief collections were found just above this Patagonian layer. To us it is equally important, as our collections all come from below this layer and must therefore be older than the Patagonian.

To get at the conditions during the deposit of the Pyrotherium beds in which we are chiefly interested, let us begin

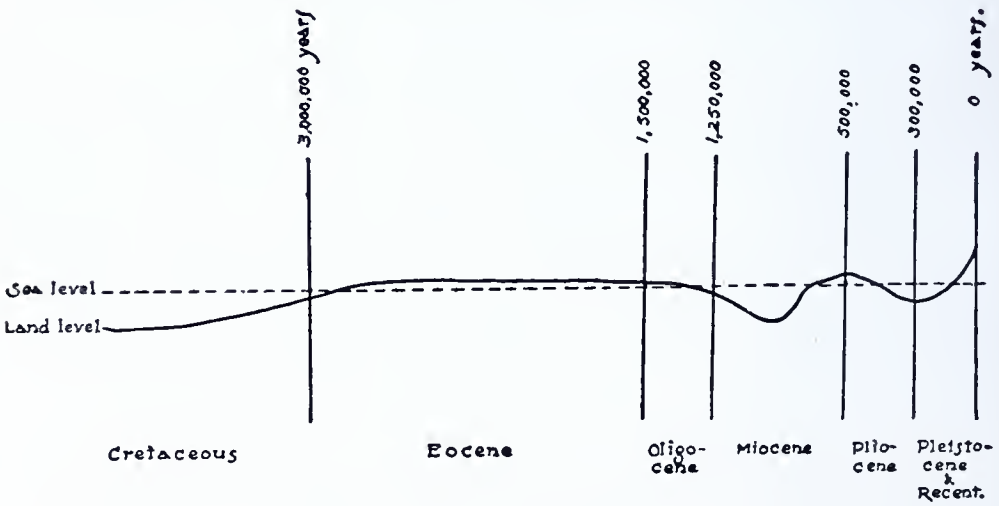


Diagram to Show the Rising and Fall of Patagonia as Indicated by the Rocks

at the lower horizons and survey the series. At sea level we found a thick layer of shales carrying marine shells of shallow water types, especially various sorts of oysters. Higher up the beds became sandy or clay with occasionally a bed in which occurred marine shells and shark's teeth. The major part of these beds, some 600 feet in thickness, were barren, except as they had occasionally some fossil wood in them. They are what Ameghino calls

"Guarantic," and considered to be Middle to Upper Cretaceous. He seems to consider them mostly land deposits because in them have been found dinosaur bones, and because they so generally have fossil wood; in describing which last Ameghino even goes so far as to state that in these petrified forests the trees are often standing where they grew. We never saw any wood in such a position that it could be standing where it grew, and indeed its very position and distribution seemed to mark it for drift wood, while the occasional beds with marine shells confirmed my belief that the beds were all marine, and apparently of Upper Cretaceous age.

Toward the end of the Cretaceous or during the early Eocene these beds were raised to low-lying land, and the Eocene epoch is only represented by the break or unconformity between these beds and the overlying Patagonian ones. During this time of elevation such rivers as coursed over or through these low lands, made small deposits in their beds or on the adjacent flood plains, in which naturally were buried the bones of such animals as died in or near the stream. These deposits therefore form pockets in the upper part of the Guarantic though of later age. It is these which have been termed Notostylopus and Pyrotherium beds, always limited in extent and of but infrequent occurrence. Their age may be anything from Early Eocene to late Oligocene, its exact time only to be determined by the contents of the beds, and as these are totally unique the determination is largely a matter of judgment. Our pocket on the Chico River is in this class. It is clearly later than the Notostylopus beds as the animals are much more specialized. The animals of the Pyrotherium beds have many affinities with those of the Santa Cruz above the Patagonian. The time necessary to lay down the 600 to 1,000 feet of the Patagonian beds would fully account for such changes as we find, and therefore I feel confident that these Pyrotherium beds should

be considered as but little older than the directly overlying Patagonian; that is, I would consider them as belonging in the Oligocene epoch instead of in the Cretaceous as Ameghino has put them. In fact, from the Cretaceous we know of only the most primitive and smallest of mammals, and placing these beds with their representatives of typically tertiary animals in them, would only be permissible as the result of overwhelming evidence to that effect.

Following this period of land deposits the country sank again and the inrolling waters deposited over them first the sands with their shallow-water oysters, etc., of the base of the Patagonian. This submergence continued for a long time until the 600 and more feet of Patagonian sands and clays were accumulated. During this time the climate in this section seems to have been much warmer than now, for all the genera and families are typically those adapted to tropical seas.

Again, the coast rose during the period when the Santa Cruz beds were deposited, a time when there was much volcanic action, for the large part of those beds are composed of volcanic dust and ashes. During this time the rivers began cutting away and dissecting the land, and only in favorable places were there any land deposits. In other places it was wholly a story of cutting river valleys and removal of land. This is the second half of the Miocene, and during it the general outlines of the present topography were carved out, the great valleys like those of the Chubut, Chico, Deseado, etc., rivers being then formed, occupied now only by tiny streams all out of proportion to the positions they occupy. During this time also the land must have extended considerably farther to the East than the present seacoast.

This period of elevation was followed during the Pliocene by another sinking, during which the Cape Fairweather and contemporaneous beds, carrying their fauna of shallow water marine shells, were formed. This submergence

extended inland up to the present foothills of the Cordilleras. During a part of this time the climate seems to have been even colder than at present, and according to Hatcher, in the central mountain area, ice sheets and glaciers formed extensively, which, as in their flow they came to the sea, brought great quantities of débris. When the ice broke away and floated as icebergs out to sea, the débris (stones and gravel) dropped to the bottom as the ice melted, strewing the whole sea floor with several feet of this material.

In the latter part of the Pliocene and during the Pleistocene the final elevation (still going on) of the land took place. Then the action of the tides and waves destroyed much of the former marine deposits, and in particular, worked over the stones and gravel dropped by the ice, making them into a layer of rounded pebbles, which forms the shingle mentioned on page 57, and covers the whole of the Patagonian pampa as far as the foothills of the mountains. This formation of shingle is still going on, as is readily seen anywhere along the beach. Almost everywhere the beach is made of rounded pebbles to the depth of ten to fifteen feet, and the material is not from the adjacent bluffs, but consists of all sorts of trap rocks, which occur in abundance far in the interior. No other cause except the ice previously mentioned will explain their presence here on the beach. The rising of the land going on today is clearly indicated at numerous points by the series of beaches one behind the other extending far inland. At Solano Bay, for instance, we counted eight such beaches.

The animals represented by our collections of bones represent a very advanced and specialized fauna comparable to none found on any other continent. It is from the relationships of the land animals that conclusions as to whether they have migrated from one continent to another are formed, and thus as to what connections a continent had.

The geography of South America during the time when

our animals lived is another much discussed problem with almost as many conclusions as there are writers on the subject. There are no faunas which arose independently and have not received some contribution from other continents. The mammals arose apparently on the northern hemisphere or were at least spread over it from their earlier beginnings. Their presence in South America indicates that they came from some other region, though their peculiarities may be due to isolation. The fresh water fishes of South America have more affinities with those of Africa than with other continents. The fresh water mussels and snails also show a striking resemblance between the two continents. This is true of some of the fossils of the Cretaceous, like the dinosaurs. In general there is an agreement that Africa and South America were united across the South Atlantic in the early Cretaceous, but the usual opinion has been that these two continents were separated early in this period. This was too early to account for the mammals, etc. By several authors there has been a tendency to continue this connection to later times, in which case we should expect to find resemblances between the land animals of the Eocene at least. Such resemblances have in many cases been asserted but mostly on incomplete material. For instance, Ameghino considered that the Pyrotherium belonged in the elephant family and was closely related to remains of elephants found in the Fâyum desert in northern Africa. The nearly complete skull which we found, however, shows no resemblance to the early elephants except in the shape of the grinding teeth, but in the important structural points it approaches to Toxodonts, which are a purely South American group. Of the evidence for an African migration very little if anything remains. There are forms which Ameghino interpreted as Primates and which would point to a connection with North America, but these with fuller material prove to be marsupials and that connection fades. The

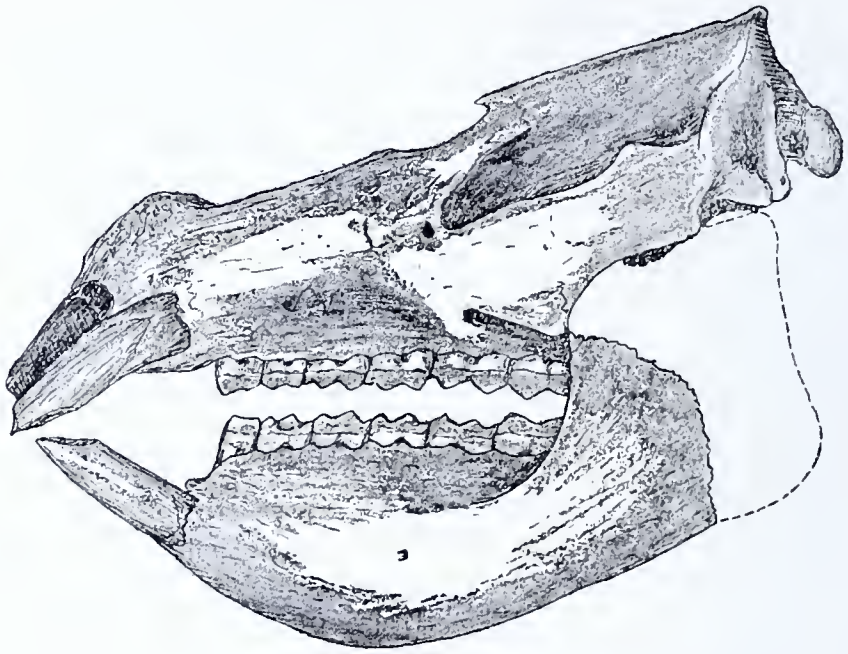
most striking feature of the group of forms we found is their entire isolation in relationships, from any of the Eocene or later forms on any continent. It looks as though, from the beginning of the Eocene at least, South America was an island continent, as it remained until in the Pliocene when the Isthmus of Panama connected it with North America.

However, during the Cretaceous and probably during the upper half of this period South America must have received its original mammals from somewhere. The most primitive members of this fauna seem to resemble the primitive stock from which the mammals of North America arose; and, as it now seems, these two continents must have received their original stock from the same source, possibly then from Africa, more probably from the north over Greenland, etc., from northern Europe, whence it spread into South America, and then the two continents were separated and the animals of each continent developed each in its own way, adapting themselves to similar circumstances often in more or less parallel manners.

Our collections contain bones representing over 300 individuals, some represented only by a fragment of a jaw or by a limb bone, but most by at least a jaw, a skull, or in four cases by more or less complete skeletons. The most striking specimen is the complete skull of Pyrotherium, a form previously known only by the teeth. The skull, thirty-eight inches in length, is greatly elongated, with the nostril openings nearly half way back from the front of the snout, indicating a flexible proboscis, though not a pendant one. In the front of the upper jaw are four heavy tusks, which is double the number that was expected. Each of them projects some ten inches to the front, and they are matched with two similar ones in the lower jaws. The back teeth are very large, each with two high ridges across it, and the two rows so broadened that almost the whole palate is covered with the dental armor. It looks as if the food required very effective crushing and grind-

ing, such molars being associated with the eating of twigs and branches of trees, where the amount of woody material is great in comparison with the available food.

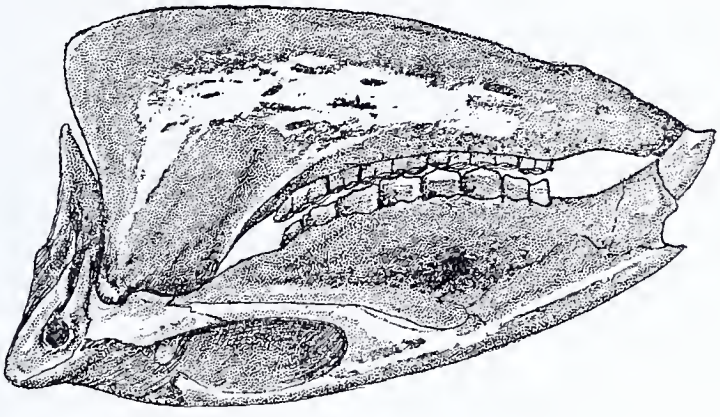
The neck vertebræ with this specimen are very short and stout, the leg bones excessively heavy and short,



Skull of Pyrotherium
One-fifth natural size

with the hind leg bones the longer. Roughly, the build of the animals would suggest such a form as the rhinoceros except that it would be considerably more clumsy. The form is one which has caused much difference of opinion. As stated it has been assigned to elephants, marsupials and now is relegated to the Toxodonts. It is usually considered the test of the Pyrotherium beds, though others of the associated animals have been found without any Pyrotherium. The discussion with the most bitterness, however, has been as to whether it occurred in the Guarantic formation with the dinosaurs. Ameghino has persisted that the two were associated. Several collectors have tried to find the two associated, and failed. I be-

lieve that the confusion has arisen from the fact that these Pyrotherium beds are set into the Guarantic, though of much later age; and from this fact, aggravated by the finding of these two forms at about the same horizon, the mistake of associating them has arisen. Also from failing to recognize the time element in the separation Ameghino put these beds in the Cretaceous instead of later, with all the host of wrong conclusions, which followed from an untrue assumption at the beginning of the argument;



Skull of Pachyruckos
Three-fourths natural size

for if Ameghino's few assumptions as to age of the beds and certain affinities are granted the rest follows, especially that almost every group of animals finds its origin in South America; and we have a very unusual genealogy.

There are also numerous other toxodonts, not so strikingly strange as the above, but all very heavy, clumsy animals with the front teeth specialized somewhat similar to those of rodents and the back teeth developed into powerful grinders. These grinding teeth are striking, in that they are adapted to grow throughout life, which gave their owner the opportunity to eat a very resistant type of food.

Then there are numerous typotheres, which are little animals about the size and build of a jack rabbit, except that they have absolutely no affinities with the rabbits,

nor even with rodents, but are tiny hoofed animals, which seem to have taken to eating either bark or twigs of the bushes and trees; for they have developed the front teeth until the upper ones are reduced to two having edges like blades, while in the lower jaw there are but four so arranged as to work against those in the upper jaw. In front, then, these teeth look greatly like those of a rodent, and the back teeth have been modified into permanently growing grinders, like those of some of the advanced rodents; so that the conclusion seems fair that these changes are due to a change to food something like that of rodents, and the result a development of this style of teeth. In all other features, however, that is, the feet with their hoofs, the arrangements of the bones even in the skull, etc., the animal shows that it was descended from herbivors.

Then there are litopternas, which are roughly like the early horses in build with three toes on each foot, and similar teeth, *but* again it is a case of the surrounding having impressed on a form the general shape which adapts it to a given type of country, and not a case of relationship. There are small species the size of a sheep, and others as large as the modern horse. Our finest specimen consists of a lower jaw, twelve vertebræ, and the two hind legs, which, as this is the earliest member of this group, will add greatly to our knowledge of the history of this group. It is in many ways a fascinating group, for the later members have completely paralleled the history of the horse, reducing their toes through three to one on each foot, and developing the long slender limbs and long head of the horses.

All these are herbivors or ungulates, and numerically over half of our collection is made up of them. However, if the tiny rodents which occur in considerable numbers, though they really make up but a very small part of the life of the area, are omitted, fully three fourths of all the finds belong to the ungulates or hoofed animals. In the number of different kinds the same seventy-five per cent.

ratio holds; and this is very striking, for in the Santa Cruz beds, the next later land deposits in this same region, more than half of all the animals found are edentates belonging to the armadillo, sloth, etc., families, while in the Pyrotherium beds there are scarcely fifteen specimens of these typical South American forms; though from the large number of plates in the covering of an armadillo it is always probable that one or two will come to light, there being thus over twice as many probabilities of an armadillo find as of any other group, for they have over twice as many bones to an individual.

There are over one hundred rodent jaws, of some eight different species, all belonging to typical South American families. They are not far different from the Santa Cruz forms, and these all belong to families still confined to South America; or, in the case of the porcupine, migrants from that continent in comparatively recent times. We have ancestral members of the porcupine family, the Guinea pig, and the cane rats, which offer no connections with any other group which would explain whence they came.

Carnivorous forms are rare, but there are a few forms which lived by preying on other animals, and these all belong to the extinct group of Sparsodont marsupials. This presence of marsupials has caused a theoretic connection with Australia, by way of the Antarctic continent; but the relationship is so distant and the difficulties in the way of that connection so great, that it seems much simpler to look in some other direction for the origin of these forms, especially as during the Cretaceous this ancient group was already spread over North America and Europe, the members of the group being on these two continents even as early as in the Jurassic; so that it would be more natural to feel that the same migration which introduced the earliest ungulates brought also the marsupials. As suggested above, this may have been from Africa during

the Cretaceous, but to my mind even more probably from North America in the Cretaceous. What Ameghino considered Primates have been assigned to these marsupials, and the few specimens which we found, belonging to the type known as "Primates," clearly fall into this group of marsupials. This leaves as an unsettled problem the origin of the South American monkeys.

The fossil woods which we found have not been studied, and when this is done they should throw some light on the age of the beds in which they occur, and especially on the type of climate under which they grew. The abundance of this wood is striking and would indicate a heavily forested region for its source.

Considering the peculiar character of the dentition of so large a proportion of the animals which have come from these early South American beds, two features are striking: the tendency to develop gnawing types of front teeth, similar to rodent types, and the tendency to develop teeth which grow permanently. Both these features are different from grass feeders, or feeders on soft vegetation. The Patagonian pampa today is covered with bushes, and the wild animals have to eat largely the twigs and ends of the branches. It seems to me that the chief food of the above forms must also have been woody. It is this line of thought which we apply to the rodent to explain its type of dentition, and it seems proper to carry it over to these other groups which have in so many respects similar structures. If this be a fair deduction we must think of the ancient country as covered with a scrub brush which, while providing plenty of food, gave it in the least usable form, requiring for mastication powerful dental development.

One other feature is notable in the animals of this fauna, and that is the presence of large numbers of birds' bones. The largest of these is a femur four inches in diameter, which must have belonged to a running bird equal in size to the extinct monsters of New Zealand and Madagascar,

that is, the bird would have stood ten feet or over in height. Similar monsters among the birds occur in the Santa Cruz. With these are also smaller running birds, and also flying forms, some no larger than a robin. But it is very unusual to find many bird bones in a land deposit; so that from the presence of over twenty finds of birds we must conclude that they were very abundant among the creatures of that time.

The large numbers of shells will offer little new, but are of primary importance in determining the ages of the rest of the material.

The collection of Indian implements, while not large and picked up as a side matter, offers several features which are of general interest, like the novel types of hammers, and the similarity in the workmanship of the North American types of Indians.

It will require a year of work on the part of several individuals to complete the study of the material, and as soon as it is done the final results and descriptions of new forms will be brought out as the second volume of this report.

Form 47

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